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CIVIL ENGINEERING.

On the Resistance of the Atmosphere to Railway Trains, and a Means of Lessening the same. By H. Bessemer, C. E.

The amount of absolute resistance of the atmosphere, to bodies moving through it at high velocities, is still a moot-point, and perhaps in no branch of engineering have we greater discrepancies in opinion, as to the actual loss resulting from this cause. Dr. Lardner, who devoted a good deal of attention to the point in question, arrived at the conclusion, that the atmospheric resistance offered to passenger trains moving at 30 miles per hour, was 15 lbs. per ton of the gross weight of the train, or 1½ times the whole amount of the resistance caused by all the other power-absorbing forces combined. It is easy to see, however, that this mode of calculation must be anything but correct, as the resistance will vary, not according to the greater or less weight of the train, but as the greater or less area exposed to the direct atmospheric resistance, together with the shape of the front or leading carriage. The most generally acknowledged rule is, that at a speed, for example, of 35 miles per hour, the resistance is 6 lbs. per square foot. This is convincingly confirmed by a series of experiments entered into by Mr. Bessemer, who has devoted his attention to this greatly neglected question. He says,

"In my experiments before referred to, I fitted up an apparatus consisting of a horizontal wheel supported by a vertical shaft which was

driven by bevel gear, and connected to a steam engine. The horizontal wheel was keyed firmly to the shaft, and carried upon it a second wheel made of wrought iron, and free to move upon the shaft. This second wheel was placed above the first, and supported upon it by small anti-friction wheels of steel attached to the upper one, so that the upper horizontal wheel could revolve with exceedingly little force. One of Salter's spring balances was attached, by its opposite ends, to one of the arms of each wheel, so that the two wheels were made to move in concert, excepting when any opposing force was applied to the progress of the upper wheel, when the spring balance served to indicate the amount of such opposing force. But as the indications could not be read off during the experiment, I attached to the index a pencil tracer and card, so that when the apparatus was at rest, the resistance which had been indicated on the card could be read off.—Matters having been thus arranged, a model carriage of wood, on a scale of one-sixth the size of those in use upon railways, was attached to the light iron wheel, and the apparatus put in motion. The amount of resistance opposed to the passage of the carriage through the air, was ascertained by the wheel on which it was placed moving on its friction rollers, and indicating on the spring balance the number of the pressure. The speed was gradually augmented from the time of starting, in each experiment; and when the number of revolutions per minute was attained, which was equal to the number of miles per hour previously determined on for each series of experiments, the speed was gradually diminished, till the carriage was brought to a state of rest, when the indication on the card was copied off, and the same experiment twice repeated, so as to obtain, in all cases, the mean of three experiments. The first series indicated a resistance of 2·1 lbs. per square foot of front surface of carriage, at 20 miles per hour; a resistance of 3·2 lbs. at 25 miles per hour; a resistance of 4·5 lbs. at 30 miles; a resistance of 6·1 at 35 miles; a resistance of 10·0 at 45 miles per hour. The last was the highest rate of speed which the apparatus was capable of moving at, without danger of derangement; and the resistance at this rate per superficial foot of frontage of carriage amounted exactly to 10 lbs. I took this speed as the basis of my subsequent experiments, because the various pressures, being expressed in round numbers, will impress themselves more distinctly on the mind than if decimals were used. Having thus ascertained that the pressure amounted to exactly 10 lbs., on the end of the model carriage of 1 foot square, a second carriage was placed between the buffers left open, as is the present practice on railways. The two carriages being put in motion, at the selected rate of 45 miles per hour, the resistance indicated as the mean of three experiments, was 14·1 lbs., so that, striking off the decimal, we have 4 lbs. resistance per superficial foot of the second carriage. A third carriage was connected before, and the experiment proceeded with in a similar manner. The indication was now 18 lbs., showing an addition of 4 lbs. for the third carriage. Three more carriages were successively added, and the result in each case was precisely 4 lbs. per superficial foot. A train of six carriages being thus connected, the spring balance indicated 30·5

lbs., but, as before stated, I throw off the decimal, and thus obtain 10 lbs. resistance for the first carriage, and four pounds for each of the five following carriages, making 20 lbs. resistance for the intermediate carriages, or $\frac{4}{10}$ as much pressure on each of the last carriages as was exerted on the first. Having arrived at this important result, the next stage of experiments, and that on which depended entirely the success of the plan I had devised in my mind, for reducing the atmospheric resistance on the ends of the intermediate carriages, was now to be tried. For this purpose, I had five small hoods of wood, made to fit into, and fill up, the intervals between the ends of each carriage. One of these hoods was placed in between the first and second carriages of the train of six, which thereby presented externally the appearance of a double carriage, without any vacancy or space between them, for the atmosphere to impinge against. The train was now brought up to 45 miles per hour, and the mean of three experiments showed a diminution of 4 lbs. in the general resistance. A second space was then filled in, which resulted in another reduction of 4 lbs.; the remainder of the spaces were then successively filled up, with a like result in each case. The train presented, at last, the appearance of one immensely long carriage, without any break or interval to catch the air, and thus arranged, the whole train suffered only a resistance of 10 lbs., being precisely the same as that of a single carriage, and clearly demonstrating, that, in the case of a train of six carriages, $\frac{2}{3}$ of the atmospheric resistance could be saved, by merely filling up the intermediate spaces.

"The next point to be ascertained was, how much farther the remaining 10 lbs. could be reduced: with this view, two more carriages were constructed; the ends were of a wedge form, like the bow of a ship, that is, the floor and roof of the carriage were pointed like the bow, while the sides of the carriage were left perpendicular, thus forming a sort of equilateral triangle, with its base attached to the parallel sides of the carriage. It was my intention to place one of these carriages at the fore, and the other at the after part of the train; one of them was accordingly placed in front, and the train brought to a velocity of 45 miles per hour. The pressure indicated, was now reduced from 10 lbs., to 6·3 lbs., although seven carriages were used. This was the first of three experiments intended to be made to get a mean, but, unfortunately, in the second experiment with these seven carriages, the centrifugal force was so enormous, that one of them became detached, and abutting against a side wall, formed a solid obstruction to all the rest, and the result was the destruction of the whole train of carriages. I was thus prevented from making the farther trial with the wedge-shaped carriage placed at the stern. I had intended to put my apparatus again in order, for the purpose of trying this last-named experiment, and also with a view of ascertaining the most advantageous form of wedge, but pressure of business prevented this being done at the time, and I have not since had leisure to resume the inquiry. However, I have clearly demonstrated this much—that the resistance of the atmosphere to railway trains, is exerted on the ends of each of the carriages forming a train, and amounts, in each

case, to $\frac{4}{10}$ of the power exerted on the first; and also, that, by filling the intermediate spaces between the carriages, this pressure on them will be most materially diminished."

The care with which these trials have been conducted, leaves no doubt as to the accuracy of the results; their tendency will, no doubt, be to induce practical engineers to probe deeper into the details of the best forms for carriages, with a view to the diminution of the propulsive power, so ably discussed by our author. The experiment of the filling up of the spaces between the carriages, opens up to us consequences of a more serious aspect than we were before aware of. Mr. Bessemer appends a series of tables, setting forth the diminution of the resistance, with his wedge-shaped carriages, and filled up spaces, as compared with the widely separated, and flat fronted ones of the ordinary construction; the loss of power, in the latter case, being based upon the observations both of Dr. Lardner, and Mr. Robert Stephenson. According to the formula of the latter gentleman, the resistance of three trains, of 10, 15, and 20 carriages respectively, moving at 35 miles per hour, with a gross weight of 40, 60, and 80 tons, experiences a detrimental resistance, including all sources, of 1200, 1800, and 2400 lbs., whilst, by the use of Mr. Bessemer's modified carriages, the same conditions are represented by 574,781, and 986 lbs. of total resistance. In the express trains, where the speed is increased to 60 miles per hour, the total opposing forces amount to 2800 lbs., while the author contends that his proposed practice would reduce this down to 922 lbs., or less than one-third.

The mode in which he proposes to effect the filling up of the spaces between each carriage of the train, is clever and easy of application. Each end of the carriages is fitted up with a hood, or flexible covering of leather, or gutta percha, similar to the ordinary collapsible coverings of pleasure carriages. The frame of the hood is attached, by hinges, to the projecting head of the buffer, and is strengthened from within, by suitable diagonal braces. The whole may be brought into a small compass, when out of use, by the joints, which permit the upper ends of the supporting frames of the leather to fall inward, towards the end of the carriage. With reference to the absurd practice of crowding the carriage roofs with luggage,* Mr. Bessemer remarks very pointedly:—

"From what has been said, it will be clear, that the practice of putting luggage on the roofs of the carriages, is a most preposterous mode of conveyance. Take, for example, a portmanteau three feet in length, by one foot high, presenting a surface of 3 superficial feet: at 30 miles per hour, this gives a resistance of 13·5 lbs., and assuming, as before, (which is really more than ample,) that 10 lbs. will draw a ton, we have a resistance, caused by this single portmanteau, equal to a weight of 2880 lbs inside the carriage! And if we apply this rule to express trains, moving at 60 miles per hour, the resistance increasing as the square of the velocity, we have $2880 - 2 \times 2 \cdot 11520$ lbs., or little more than 5 tons, as the equivalent load inside the carriage. According to

*This mode of carrying baggage is not practised in the United States—here it is all carried in a separate car, and under lock and key.

the method I have proposed, of closing up the spaces between the carriages by elastic hoods, these will form convenient space for the stowage of luggage, and where they would be secure from rain or dust." Glasgow Prac. Mech. & Eng. Mag.

The Late Failure of the Chester Bridge.

The newspapers of the day will have informed our readers of the primary details of this lamentable occurrence. A variety of opinions exist as to the true cause of the giving way of the girders, but the results are quite sufficient to place us on our guard against too great a reliance upon Cast Iron employed in the manner it is here. The account of the accident, as furnished by a resident in the locality, is as follows:

The Chester and Holyhead Railway is carried along from the Chester station, by the side of the Roode, on a handsome viaduct, and crosses the River Dee at the extremity of the Roode, nearer the city than the celebrated one-arch stone bridge, erected by Harrison, of Chester, over that river, at the other side of the Roode. The Dee railway bridge is a flat-girder bridge of iron, divided into three spans by two massive stone piers, at equal distances in the stream; and each span is formed of three lengths of cast iron beams or girders, joined together with bolts, with a semi-circular iron cap over each joint, and the beams being further trussed on the sides by tension or suspension rods, consisting of a number of parallel wrought iron plates. The beams or girders are in the rib of 2 in. metal; in the flange 2½ in. Each beam weighs probably 30 tons. Like the Menai suspension-bridge, this one has, or rather had, two roadways, the one used for the up trains and the other for the down trains; and each roadway was carried over the river on two parallel lengths of the beams we have been describing. The roadway and rails used for the trains from Ruabon, &c., to Chester is still entire and uninjured; that used for trains from Chester to Ruabon is uninjured for two-thirds of its length (viz., the two spans nearest Chester), and for the remaining third, only one of the two parallel beams supporting the roadway (viz., the outside one next to Roode) has given way, the other remaining apparently uninjured. The length of beam between the abutment and the next pier (95 ft. span) has three joints in it, and each joint is secured in various ways, viz., by bolts, lugs underneath it, with clips, &c. The accident was seen by a little boy who was fishing in the river, on the Wrexham side, near the bridge. Hearing a train coming, he naturally looked up, and on its crossing the span nearest to him, he heard a crashing noise for two or three seconds, and then, as he says, he saw the four carriages come down into the river "in a string." From the rails to the surface of the water, at the time of the accident (in the then state of the tide), is a distance of about 30 ft. (and not, as some accounts have stated, 120 ft.) The account of Clayton, the engine-driver, the only individual on the train who passed over safely, is as follows:—When passing over the third

span from Chester, he felt the rails sinking beneath him, and he instantly put on the steam, and then felt the carriages severed, while the engine and tender cleared the bridge, and reached the abutments on the Wrexham or south banks of the river in safety; but the jerk or wrench arising from this severance threw the tender off the rails, inclining it sideways towards the stone parapet; and by the marks of the tender's paint upon the stone, and the friction caused by the stone on the timber of the tender, its course whilst literally riding on the upper part of the parapet may be plainly traced. The tender was finally thrown somewhat on its side, and about three feet off the rails, on the east side; this shock severing it from the engine, the iron bar or hook connecting them being snapped in two. The stoker, whose name is Anderson, was by this shock thrown off the tender upon the rails, and the screw-jack from the tender falling upon him, killed him on the spot. The engine continued its course along the line, and, fortunately, Clayton, the engine-driver, escaped without hurt. His conduct in this trying and perilous position seems to have been most praiseworthy, displaying great coolness, intrepidity, and presence of mind. He proceeded to the first "points," and there gave the alarm; and then went on to the Saltney station, and there obtained the assistance of a number of men who were repairing the road, and who at once hastened to the spot. Clayton then piloted his engine back, on the other line of rails; and, notwithstanding the fearful catastrophe which had just before occurred, he boldly recrossed the bridge, and communicated the fact of the accident at the Chester station. The bridge and river presented a singular spectacle after the accident. The whole of the easterly roadway between the south abutment and the next pier had fallen, that portion of the beam next the pier resting its upper part against the pier, the lower part in the river; and the upper course of masonry of both pier and abutment had been carried down by the beam in its fall. The three carriages and the van were lying, much smashed, in the river; and the south bank was covered with fragments of the roadway (which was laid on transverse wooden sleepers, resting on the parallel beams), masonry, soil, &c. Upon examining the beam as it lay in the river, I could perceive two fractures in it,—one of which, in the middle length, had to all appearance, been the result of the fall, and not anterior to it. The other, doubtless the immediate cause of this frightful accident, was from 17 to 20 ft. distant from the south pier of the bridge; and, as the engine-driver said he felt the giving way beneath him, allowing for the length of the tender, there can be no doubt that this was the fracture which caused the calamity. The fracture was directly across the beam, from its upper to its lower flange; and connected with this was another fracture, running in a line nearly parallel to the bottom flange for about 4 feet, and then curving across to the upper flange for a length of 4ft. more. This, however, might be caused by the fall, the flat side of the beam striking against the rock or other hard substance. The trusses or tension rods, so far as we could see them, appeared to be entire. Until this massive girder is got out of the water, which in part conceals it, it is impossible to say what may have been the cause of its

fracture. So far as it could be seen, it did not appear to be from any flaw or defect in the metal. In one account I have seen, the accident, it is suggested, may have arisen either from the piers not being sufficiently consolidated, or the stone defective, or the iron bearings becoming warped by some heavy trains of iron from Ruabon passing over them, or from an unstable foundation. So far as I could judge, none of these appeared likely to be the real cause of the accident. The piers are quite firm and still standing; and just so much of the masonry has gone as the beam would be certain to drag downwards with it; and as to heavy trains of iron from Ruabon, I learn that there had been nothing of the kind—no wagon bringing more than 4 or 5 tons of iron. Indeed, the bridge was most severely tested before it was open to the public, by trains of ballast wagons passing over it,—probably 30 loaded wagons of 7 tons each, or 210 tons altogether over the whole structure. There is not the slightest appearance of the foundation having "settled" in such a manner as to endanger the structure, and it being only one beam that has given way just one-sixth part of the girders of the bridge—the inquiry seems considerably narrowed.

Mr. Lee, clerk of the works of the line, supposed that the girder was broken by a sudden blow at the side. The proceedings were adjourned for the attendance of General Pasley, who had certified the security of the works.—June 2. Mr. J. Walker, C. E., sent down by the Admiralty, Captain Simmons, the deputy-inspector of railways, and Major Foster, the inspector of fortifications, also attended on the part of Government. Major-Gen. Sir C. Pasley was present. Messrs. Locke, Vignolles, and Gooch, engineers, were in attendance to give evidence as to the solidity and construction of the bridges.—W. Clegg, W. Clark, and Mr. W. A. Rowland, who had painted the bridge in April last, noticed the deflection of the bridge between four and five inches, whilst a ballast train passed over it. N. Welman, stonemason, engaged in building the bridge. It was erected according to the plans and specifications. It was originally intended to have carried the bridge over five arches, but in consequence of the interference of the Tidal Commissioners, the works were for a time delayed, when those now erected were determined on. He had, since the erection, examined the masonry, and not discovered any settlement of the piers or abutments. He did not think the girders safe; they were not properly supported by the stanchion rods; but never told any one that it was unsafe. W. Watson, a contractor's agent, was desired on Monday to put some ballast on the railway bridge. He followed the 3h. 23m. down train, and commenced distributing the ballast. About 20 wagons of ballast were distributed. Did not observe the deflection of the girders while the train was on the bridge. The next train that came over was the 6h. 15m. passenger one, which met with the accident.

Major-Gen. Pasley said, I was the Government Inspector-General of Railways when the Chester and Holyhead was opened; I surveyed the bridge over the river Dee on the 20th of October, and reported it as safe; examined it in such detail as I deemed necessary. It is

an iron girder bridge of three openings or spans of 98 ft. each; wrought iron tension rods are used to strengthen it. I always was of the opinion, and am so still, that these tension rods are not of great use, because I consider that the expansion of wrought and cast iron from heat differs in some degree, although not very greatly; but that iron girders being very massive and the tension bars thin and of small dimensions, the sun may act on the wrought iron rods very considerably and less on the cast iron girders, and, supposing them to be adjusted for a moderate temperature, the intensity of hot weather may destroy their proper proportion and do away with the benefit of the tension. I may here state that wrought iron when acted upon will elongate considerably without breaking. There have been a number of bridges of this description erected on railways in various parts of England, both before and after I held the appointment of Inspector-General of Railways, none of which, with the exception of this one, ever failed. They were not quite of the same extent, but I will allude to a cast iron girder bridge at York, over the river Ouse, of the York and Scarborough, which has two openings of 70 ft. span. The least depth of the iron girder on that bridge is 3 ft. The least depth of those on the Dee bridge is 3 ft. 9 in.; and as the bridge at York and other similar bridges have stood, I concluded that this one would, as it had an extra depth. I may also mention another bridge over the Tees at Stockton, although I have not seen it. I may vouch for what I state to be correct. It has a span of 83 ft. 4 in. and the least depth of iron is 3 ft.—Mr. R. Stephenson said it was 87 ft.—General Pasley: you may be correct. The flange on this bridge is greater than on others. I have frequently mentioned to engineers that wrought iron tension rods would do little good. In my inspection of a cast iron girder bridge, on the System of Peterborough, built by Mr. Liddle, I found that he had omitted tension bars, and in my Report to the Earl of Clarendon I approved of the omission, and considered it a preferable construction. It appeared that Mr. Liddle could not get the tension rods in time, and therefore he built the bridge without them. It has been stated that some time after the Shrewsbury and Chester was opened and after I had inspected it, a girder was cracked and replaced by a new girder. This circumstance, which I did not know, and which was never reported to Government, coupled with the fracture of this one, induces me to think that they are not safe, and that it is the mere cast of a die between their safety and danger. They are on the verge of danger. By examining the bridge on Thursday last and to-day, I consider that the tension rods are of very little use indeed. The tension rods are connected with the girder alone, as if they were part of it. They have no independent support, and there is a difference between this bridge and Mr. Stephenson's former iron girder bridges. In all his former iron girder bridges there is a connexion from girder to girder, on the central pier or piers, from one end of the bridge to the other, so that when the pressure is on one girder the other girder in the same line contributes to assist. That is the case with the one on the river Ouse at York. The horizontal portion of these bars appears to be useless. The oblique tension bars

would be of use if the upper ends were fixed to some independent support to each pier, and similar independent support on each abutment, and if the standards or support over the abutments had tension bars extending inland to resist the heavy weight going over the extreme bays or openings of the bridge. There is a swing bridge over the river Wensham at Norwich, strengthened on this principle, and which is extremely judicious. In this case I consider that the girder broke on a train passing over, added to the weight of the ballast that had been thrown on it in the course of the morning. The masonry gave way from the girder breaking, and from that cause alone. I examined the girder, and the castings seemed very good, and I believe it is generally admitted that they are good, but the girder was too weak after the ballast that was put upon it. The girder was far enough in the masonry to support it. There was bearing enough to render it secure.—Coroner: Would the engine-driver suddenly putting on the steam, cause the engine to bound with such force as to break the girder?—Gen. Pasley; No, certainly not. I saw nothing to throw the engine off the rails on the bridge, which had strong guard rails. I should say that no girder could have withstood a deflection of 5½ in., as stated by a witness this day. I think that person is a very inaccurate observer. It would have broken short at once. A continued deflection of 4 in. must have broken it long before this occurred.—Sir E. S. Walker: If this bridge were restored to its original state, would you be prepared to pass it fit for public security?—Gen. Pasley: No, I would not, as I am not infallible. Although I did sanction its opening, I should not now allow trains to pass over it without fixing independent supporters. It could be rendered perfectly safe by adopting what I suggest. For my own part, and I am not troubled with nervousness, I certainly should not like to travel over it until it was secured as I have stated.—By Mr. Tyrrel: I do not believe that the tender ran against the outside girder. I noticed the masonry that was disturbed. I did not measure the height of the abutment; in reference to the tender I did not notice in particular that the chains were broken. I was told that one of the wheels of a carriage was broken, and I am only surprised that they were not all broken. In all the railway accidents that I have had to inquire about I never found a train precipitated into a river.—By Sir E. Walker: If the tender had struck the girder I should say that the stoker might have been thrown into the river. I noticed that the tender had struck something. The nature of the accident has proved to me that there was no defect in the flange, but brackets or girders would be a great improvement. Mr. Robert Stephenson, the engineer-in-chief of the Chester and Holyhead, being sworn, handed to the coroner the following Report on the accident which he had made to the directors:—

1. The masonry of the wing parapet on the Saltney side was much shattered and displaced, bearing evident marks of having received a violent side blow. 2. On examining the tender of the engine it was clear that it came violently in contact with the masonry, and caused the disturbance just alluded to. 3. All the lateral ties which bound

the girders together sideways, thirteen in number, each measuring 4 in. by 1 in. (giving a total area of 52 in.), were either torn from the sockets in which they were formerly fixed, or forcibly wrenched off near to the sockets of the girder left standing. 4. That portion of the broken girder which is now lying against the pier at a considerable angle, must have been drawn off the pier, and after the fractured end had reached the ground, the end which rested upon the pier must have fallen back upon the upright side with great force, as is shown by the deep indentation made in the masonry by the upper end of the girder, without any trace of violence between the top course of masonry and the indentation. 5. On examining the wrought iron work of the girder the whole was found sound, except one of the leaves of the internal wrought iron link, against which the tender or the carriages would necessarily strike on leaving the rails, which was severed about 18 ft. from the Saltney abutment, and near to the point where the first fracture of the girder itself took place. 6. On examining the broken girder itself, the fracture was precisely such as might be expected from a large piece of the vertical rib being broken out of the girder, and separated from the lower flange, which remains perfect; a description of fracture which could scarcely be produced by a vertical action.

After attentively reflecting upon these facts as indicative of the movement which took place during the accident, I can arrive at no other conclusion than that it arose from a violent side blow against the girder, near to the abutment on the Saltney side; that this was the first place of fracture; that the other fractures were consequent upon the fall. The tender of the engine had incontestibly left the rails before reaching the abutment, because it struck the very first portion of masonry and moved it laterally. The tender must have been considerably raised up, because the marks on the masonry are much higher above the level of the railway than those parts of the tender which have produced the effects when in their proper position. These two circumstances leave no doubt on my mind that the tender, and probably some portion of the train, were off the rails some distance before reaching the Saltney abutment. If we suppose the fracture to have taken place by vertical action, it is evident that this would give no tendency to side motion until the platform of the bridge assumed an angle in the direction of the broken girder: but the horizontal ties connecting the girders on opposite sides of the roadway would immediately come into action to prevent any side motion. They clearly did so, and their great strength and number is fully equal to the entire suspension of the platform and girder after fracture, consequently they would tend to draw the broken girder in its face underneath the firm girder, which was left standing. This tendency having been entirely counteracted is another proof that great lateral action had come into play. With this view of the subject, the question naturally arises, what would cause any portion of the train to leave the line? The entire demolition of the platform unfortunately prevents even a probable reply; yet there is a fact connected with the state of the wheels of the carriage as found in the river which seems

to justify the suspicion that a wheel did break antecedent to the accident. All the wheels were found in a sound state except one, which was, I am informed, entirely destroyed, the rim and spokes being stripped from the boss. Now, the simple fall of a carriage, even with other carriages, is scarcely likely to cause such a destruction to a wheel; on the other hand, any accident to a wheel in a train when in motion would cause such a separation of the rim and spokes from the boss. Whatever may have been the primary cause of the accident, I think it is most clear that a violent lateral blow was the immediate cause of the fracture of the girder. It has been urged by some that the existence of check rails throughout the whole length of the bridge precludes the possibility of any portion of the train having left the line. To those acquainted with railways practically, no argument need be adduced to controvert this opinion, since it is well known that, in any violent collision amongst the carriages of a train, check rails scarcely ever avail, as they are only calculated to counteract any moderate tendency to leave the rail, and are consequently very generally adopted on long viaducts.

In considering this accident some persons, whilst they acquiesce in the evidence tending unequivocally to establish a violent side action, endeavor to attribute it to the centrifugal force arising from the railway being on a curve throughout the length of the bridge. Now, there can be no doubt that such a condition of the rails gives rise to side pressure, and also on viaducts to some vibration; but in the present case the radius of curvature is fully two miles, which would give for the centrifugal force, at a speed of 30 miles per hour, a lateral strain of 1-177th part of the weight of the train, which in the present instance would be about 750lb.—a pressure totally inadequate to produce any sensible effect. The curved direction of the line would doubtless occasion a little more vibration throughout the structure than if the line had been perfectly straight, and this, no doubt, might, by a remarkable occurrence of causes, occasion a little more than ordinary strain upon the bridge, but I cannot conceive such to have operated in the instance before us. Looking fairly at the fact that much heavier trains, moving at greater velocities than that to which the accident occurred, have been constantly running over the bridge since October last, without the slightest symptoms of failure, it appears to me unreasonable to attribute the accident to any combination of causes which one would say must have been daily repeated for some months past.

It has also been suggested that the unequal expansion and contraction of the girder during great changes of temperature might probably interfere with the uniform strength of the metal. It is impossible to deny that this circumstance does sometimes interfere with the strength of cast iron beams, but generally this influence may be regarded as confined to castings where the thickness of the different parts varies considerably. In the present case the form of the castings was carefully studied, and with only such small deviation from absolute uniformity in all the thicknesses of the different parts of the section as practice has long proved to be justifiable.

With regard to the competent strength of the structure, I concur generally in the deduction drawn by Mr. Yarrow, in which I am confirmed by an extensive experience in the construction and use of similar structures, tried under circumstances that demonstrate their capabilities to meet all the ordinary contingencies of railway traffic.

June 3.—Mr. Stephenson was examined, and especially with reference to Gen. Pasley's arguments. The following is an abstract of Mr. Stephenson's evidence, which we hope to be able to give hereafter in greater detail :—He (Mr. Stephenson) deeply felt the responsibility that was attached to him ; he knew that as yet the public mind was against him, but his opinion as to its solidity and construction was unaltered, and it would be confirmed ; not that it was upon a new principle, for it had been in use for years, but that it must be adopted sooner or later, for the benefit and security of the public. He then proceeded to detail a subsequent inspection he had made of the bridge with Mr. Locke and other eminent engineers. The platform being carried away, it was difficult to state the point at which the tender left the rails, but on examining the inner chair, there was an indentation as if something had bounded upon it, and it was evident that it had kept in strict contact with it all the way up, as the bolt had been scraped out. This no doubt, was the tender which had so bounded, for on viewing the stone-work of the abutment, they could trace, adhering to the face of it, some of the paint and wood of the tender. Then looking at the fracture in the girder, it certainly arose from a side blow, and not vertical pressure. Some of the chairs bore proof of something having passed over them, and from the circumstance of one of the wheels of a second-classs carriage being nearly destroyed, while the others were in a sound state, it is to be inferred that it met with considerable obstacles. What was the primary cause of the accident he was unable to state, but it was clear that a lateral blow, was the immediate cause of the fracture of the girder. During an experience of 20 years in building railway bridges, this was the first failure he had ever encountered.—Sir E. Walker inquired of him if he intended to make any alteration in the construction of the bridge.—Mr. Stephenson replied, that he proposed to make certain alterations with a view of appeasing the public mind.—Sir. E. Walker hoped he (Mr. Stephenson) would succeed in getting the public over it. All he could say was that he would not travel on it. —Mr. Stephenson trusted he would again obtain the public confidence.—Clayton, the engine-driver, was re-called, and on being asked if he saw any part of the train off the line when he felt the sinking, he replied that he did not look behind him, he was so alarmed.—Mr. Locke, engineer of the Grand Junction line, corroborated Mr. Stephenson's testimony ; he said the bridge did not fall from any pressure downwards, but from a side blow ; this, the examination of the fragments proved to him ; he considered all manner of iron bridges objectionable when brick and stone bridges could be had, as was the case, cheaper and better. "Mr. Coroner and gentlemen of the jury," said Mr. Locke, "I believe that much blame lies at the doors of the Com-

missioners of the Admiralty, the Board of Trade, and the Commissioners of Railways, who require bridges built with too large a span, to answer their views as to shipping and other matters, without at all consulting the interest or safety of the public. I wish this to go forth to the world. I wrote a letter to Government on the subject, and am sorry to say it was not attended to."

If the evidence of the witnesses, Clegg, Clark, and Rowland, is trustworthy, no doubt can exist as to the insufficient strength of the girders. We cannot understand though, how it is possible that so great a deflection as five inches, could take place without the direct fracture of the girder. Judging from the best information we have upon the point, it would appear that Mr. Stephenson's conclusion as to the ultimate cause of failure is the likeliest of any. Nevertheless we must say that we have no great faith in cast iron when employed for such large spans as the present one. Gen. Pasley's evidence has given us a little surprise, and we confess that it is a difficult matter to make out his meaning. After stating that he reported the bridge as safe, he says that he afterwards learned that one of the girders had cracked, and been replaced by a sound one, and he now thinks of "this kind of bridge, that they are on the verge of danger." If the length of span, as it undoubtedly must be, is objected to, then the Admiralty must bear the brunt of the matter, as they only permitted the engineer to have three arches, when he wanted five, and the girder form was adopted to give them the required amount of head-room.* However, if the Inspector-General of Railways felt sufficient confidence in the bridge, to pass it as safe for traffic, why does he turn round upon hearing of the cracking of a girder, and tell us that he has no faith in them?

It is not very long since a bridge fell down on the very day that the Inspecting Engineer presented his report upon its trustworthiness. We shall shortly begin to doubt the infallibility of even a Government Inspector. Ibid.

Railway Profits

The principal railway companies in the United Kingdom, having lines completed and at work, are 28 in number; the length of their lines in operation is 2418¾ miles, and the total cost, to the dates of the last balance sheets, is £77,162,952. The dividends now paid upon the different items of which this capital is made up, vary from 2 to 10 per cent., in the following proportions:—

* We have since heard that the Admiralty did not interfere, but that the engineer changed his plan from five arches to three, in order to get over the difficulties of the bad foundation for the supports.

On	£1,079,867	the dividend is	£2 0 per cent.
On	853,918		2 8 "
On	520,341		2 12 "
On	142,900		3 0 "
On	4,741,249		3 10 "
On	1,174,969		4 0 "
On	5,705,057		5 0 "
On	1,085,498		5 10 "
On	2,005,127		6 0 "
On	26,276,102		7 0 "
On	8,426,000		8 0 "
On	2,062,053		9 0 "
On	23,089,571		10 0 "
	£77,162,952		

The total dividend upon the various items above enumerated, amounts to £5,746,068 per annum, being an average of 7½ per cent., within a fraction, on the entire sum invested by the shareholders in these undertakings. It should be borne in mind, too, that the resources of many of these companies are, as yet, but imperfectly developed. In some cases the lines are but partially opened, and in others, such as the Great Western, though the main lines are complete, many of the tributaries essential to the full development of the system of which they form part, and from which much increased wealth and prosperity must necessarily flow, are, as yet, incomplete, and have brought nothing to the general fund. Lond. Min. Jour.

AMERICAN PATENTS.

List of American Patents which issued in the month of July, 1846,—with Exemplifications, by CHARLES M. KELLER, *Agent for procuring Patents, and late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Level for determining angles;* Augustus Girard, Mobile, Alabama, July 2.

This instrument consists of a straight edge, to one end of which is jointed the case of a spirit level. The straight edge is furnished with a graduated quadrant, to determine the angle which the spirit level shall make with the straight edge.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the rod, the movable piece furnished with a spirit level, and the graduated quadrant, as herein set forth."

2. For an *Improvement in the Piano Action;* Luther Phillco, Utica, New York, July 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing a roller in the upper end of the jack, and its general application to the action of the piano forte, as herein above described, by which means I am able to produce the following important results, viz:—

"First. The greater power obtained in the stroke of the hammer.

"Second. Its greater velocity.

"Third. A greater distance is passed by the hammer, in its stroke, with the same given movements of the key.

"Fourth. The certainty of the roller holding on until the proper time to release."

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3. For *Improvements in the Machine for Cutting the Nicks in the Heads of Wood Screws;* Thomas W. Harvey, New York City, July 2.

The claim in this patent refers to, is wholly dependant upon, and could not be understood without reference to, the drawing, we therefore omit it; but it is our intention to give an account of this, in connexion with other machines, patented subsequently by the same person, for the manufacture of wood screws, that the whole series may be together.

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4. For an *Improvement in the Cooking Stove;* George M. Norton, Rochester, New York, July 2.

The patentee says,—"The nature of my invention consists in an oven, so constructed as to bake perfectly even and uniform on all sides, by means of an air chamber, so constructed as to distribute the heat produced between the plates of the oven top, and the fire plate, and the front oven side, into the ends of the oven, or between the plates of the oven doors. Also, the mode of conveying the steam, produced by baking meats, or any other article producing steam, by a draught into the back flue from the oven.

"The nature of my invention also consists in the construction and application of a damper for admitting, by a draught, a great quantity of cold air, to protect the plates most exposed to the fire from burning out; and also, to regulate the heat of the oven when baking. The nature of my invention also consists in the construction of the main bottom plate of the stove, thereby avoiding the difficulty of casting separate, and keeping in its place, a flue plate, which is liable to warp and spring by exposure to heat."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of producing the draught through the air chamber into the back flue, as herein described.

"I also claim the mode of conveying the steam, produced by baking, from the oven into the back flue, as herein described."

5. For an *Improvement in the Process of Preparing Tannin, for Tanning Leather;* Wm. Germar, Easton, Pennsylvania, July 2.

The patentee says,—"The nature of my invention consists in fermenting the bark, by which process the tannin contained in the bark is fully extracted, and so dissolved, that it enters into a chemical connexion with the fibres of the hide, without becoming crystalized."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the preparation of a bark-liquor, by a process of fermentation, as herein described, to be applied to the purposes of tanning leather; using for the purpose of preparing the liquor, a ferment, and any alkali, neutral salts, or other material, that will produce the desired effect."

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6. For an *Improved Process for the Bleaching of Rags, &c., in the Manufacture of Paper;* Joseph G. & Jonas H. Kendall, of Worcester and Leominster, Massachusetts, July 2.

Claim.—"The subscribers do not claim as their invention or improvement, the use of the said acid, nor of the chloride of lime, nor of the chests or drainers, all which are well known and much used; but they claim, as a new and valuable improvement in bleaching paper-makers' stock, as rags, &c., the above described method, process, or mode of bleaching, and of applying said bleaching substances to, and upon, large masses of stock, as rags, waste, bagging, and other materials, made into paper, lying, drained of water, in chests or drainers, as set forth in this specification."

The above method or process is pointed out by the patentees, in the following extract from their specification, viz:—"The improvement for which a patent is sought, consists in the application of well known bleaching substances to the material used in making paper, as cotton, linen, hemp, &c., after the same has been washed in the engines of a paper mill, and is discharged into chests or drainers; or, in other words, the improvement consists in the process or mode of application of such bleaching substances, in such chests or drainers."

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7. For an *Improvement in the Lard Lamp;* John Davidson, Baltimore, Maryland, July 2.

The nature of this invention consists in striking out of one piece of sheet metal, the glass holder, and supporter of the deflector, and outer tube, the said piece acting as a cap over the top of the reservoir, to which it closely fits, and on which it rests.

Claim.—"Having thus fully described my improvement in lamps, what I claim therein as new, and desire to secure by letters patent, is connecting the tube and shade holder, by means of a cap, which covers the top of the reservoir, in the manner described, (the whole being made in one piece,) by which a great economy is effected in the construction, and the burning of the lamp greatly improved."

8. For an *Improvement in the Method of Increasing the Adhesiveness of the Surface of Pulleys, Drums, &c.;* John Simpson, Decatur, Georgia, July 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the giving the face or periphery of drums, pulleys, &c., upon which bands are used, a coating of India rubber, or some other gum covering of a similar nature, for the purpose herein set forth."

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9. For an *Improvement in Lifting, Suction, and Force Pumps;* Chapman Warner, Louisville, Kentucky, July 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of connecting the air chamber with the plunger, emptying the water from the holes, so that the air chamber and plunger will be elevated and depressed together."

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10. For an *Improvement in the Shank for the Knobs of Doors;* L. R. Livingston, J. J. Roggen & Calvin Adams, Pittsburg, Pennsylvania, July 7.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of making the shank for door knobs in two pieces, coupled together, near the middle, by a notched connexion, and held together by means of the escutcheon at one end, and to the latch-tumblers or follower at the other, as herein described."

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11. For *Improvements in Lamps;* T. F. Strong, a citizen of the United States, residing in London, England, July 7, 1846, antedated May 1, 1846.

The patentee says,—"The nature of my invention consists in so conducting the air to the flame, as to have it lightly heated before it impinges on the flame, without the use of the button, and in such a manner as to prevent its flaring; and also, in the mode of raising and lowering the wick, without revolving it, by means of an upright screw, that works into a nut on the bucket or thimble."

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is constructing the reservoir in the manner described, so as to prevent the oil from leaking out over the cover, while a flat broad receiver is retained, as herein set forth.

"I also claim the raising and lowering of the thimble or wick-holder, by means of the screw, constructed, arranged, and combined, as herein set forth.

"I claim the cup or sunken chamber, for heating or supplying air to the outside of the flame of an argand lamp, as specified.

"I also claim constructing the deflector with holes around and below its upper edge, in the manner and for the purpose described.

"I also claim the lamp chimney, formed of glass, with two contractions, substantially as above made known."

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12. For an *Improvement in the Furnace for Heating Buildings;* John Barker, Baltimore, Maryland, July 7.

The patentee says,—"My air heating furnace is to be enclosed in a chamber of masonry, in the ordinary manner of placing such furnaces; and the air that is heated therein, is to be conveyed through suitable tubes, to the apartments to be heated, as usual. But I have so arranged the pipes which conduct the heated air from the furnace to the chimney, as that the cold air which is admitted from without, and which is to be heated by said pipes, shall be forced into immediate contact with them, by causing it to pass up within channels formed in the brick work, which is made nearly to enclose said pipes. Of these air heating pipes, I employ a single tier only on each side of the heating chamber, and that as near to the floor as they can be placed with convenience, and nearly surrounding its four sides."

Claim.—"Having thus fully described the manner in which I construct and arrange the respective parts of my air heating furnace, what I claim therein as new, and desire to secure by letters patent, is the particular manner in which I have arranged the air heating pipes, enclosed in spaces formed of masonry on each of their sides, and extended partly over them, with an opening at top for the passage of the heated air; said pipes forming a single tier within a few inches of the bottom of the air chamber; the whole construction and operation being substantially the same with that herein set forth."

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13. For *Improvements in the Boot and Shoe Tree;* Jonathan Russell, Philadelphia, Pennsylvania, July 7.

The tree, either for boots or shoes, is made of metal, hollow, with the sole piece hinged, so that, by means of a forked lever inside, that turns on a fulcrum, with the forked ends provided with adjusting screws, and the rear end acted on by a screw that runs up above the top, the sole piece can be forced down to stretch the foot. Within the leg of the tree there is a lever, jointed near the bottom, and connected with a horizontal screw at top, and provided with a projection near the lower end, so that the lever end of the back piece can be forced out, to stretch the boot across the small and heel measures.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructing boot and shoe trees of hollow metal or wood, in combination with the forked lever, vibrating sole piece, and screws, (either with button heads or cap pieces,) combined and operating with the screw, for stretching a boot or shoe, substantially in the manner and for the purpose herein set forth.

"I also claim the combination of the screw, lever, and projection on the same, with the back piece and key of the leg of the boot tree, for stretching a boot across the small and heel measures, substantially as herein set forth."

14. For *Improvements in the Machine for Cleaning Grain;* Wm. H. Stevens, Salem, Illinois, July 7.

Claim.—"Having thus fully described my fan, what I claim therein as new, and desire to secure by letters patent, is, first, the return blast, or combination of the fan and spout, by which the blast from the fan is made to sweep around a curve through the grain in passing to the screen, substantially in the manner and for the purpose set forth.—Secondly, I claim the combination of the revolving screen with the fan, in the manner described, so that the grain shall pass to the screen after it has passed the blast from the fan, as described. Thirdly, I claim in the construction of the screen, made by winding on a continuous wire, in parallel lines, with spaces between, the method of tightening the same, by means of the outside ribs and iron bands, so as to preserve the proper distance between the wires, as above made known."

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15. For *Improvements in the Hot Water Furnace, for Warming Buildings;* Ezra L. Miller, Brooklyn, New York, July 7.

The patentee points out his two improvements in the following terms, viz:—"The first of these, which I denominate a condensing radiator, consists in a new and improved arrangement, combination, and application of the different parts and surfaces of a hot water apparatus, or furnace for warming buildings, by which the circulation of the water, in contact with the radiating surfaces, is much accelerated, and the air for taking off the heat is, in its circulation, brought and kept more closely in contact with the water-heated surfaces, than by any former method. My other improvement, which I denominate a hydro-pneumatic regulator, consists in the peculiar application of the expansibility of water and air, combined, to produce motion in a damper or dampers, for the purpose of regulating the degree of combustion in a furnace."

Claim.—"I do not c.a.... ny invention, the simple use or application of a cylindrical or other shaped vessel, filled with tubes, for the purpose of radiating heat; but what I do claim, and wish to secure by letters patent, is the combination of the condensing radiator with the hydro-pneumatic regulator, and a boiler or boilers within a hot air or furnace chamber, as herein fully described and set forth; whether the condensing radiator be cylindrical or other shaped, if so constructed and combined as to be similar in principle and effect.

"I also claim the peculiar manner of applying the expansibility of water and air, combined, to the working of a damper or dampers, for the regulation and control of the combustion of the fuel in a furnace, in combination with a condensing radiator, as herein fully described and set forth."

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16. For an *Improvement in the Furnace of Steam Boilers, Stoves, &c., for Burning Anthracite Coal;* Ezra L. Miller, Brooklyn, New York, July 7.

The patentee says,—"My improvement, which I designate a boiler

furnace, consists in making a new arrangement of the furnace or burner, for producing the most active combustion of the fuel, at or near the base of the fuel, and so near the grate bars, as always to insure the necessary supply of air to effect a perfect combustion; the combustible portion of the smoke and gases, liberated from the fuel, being consumed by passing through the most intense heat of the fire, in their escape from the burner, and by combining with this arrangement, a reservoir or chamber for fuel, above the line of draught, of sufficient capacity to contain fuel for any desirable length of time, which, as the combustion proceeds, settles into the base of the burner, and thus becomes self-feeding, until the fuel is consumed."

Claim.—"What I claim as my improvement, and wish to secure by letters patent, is the peculiar manner, as fully described and set forth in the above specification, of constructing the base of the fuel chamber with an off-set or enlargement, so as to admit of taking out the smoke flues or tubes through it, or near a vertical direction at the top of the burner, and around the circumference of the fuel chamber, and, by these means, adapting it to a furnace for boilers, as well as to stoves and hot air furnaces."

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17. For an *Improvement in the Jack, or Jack Screw;* Wm. Ballard, City of New York, July 7.

The claws project from the lower end of a screw, and at right angles thereto, and are fitted to side bars, that form sliding ways for them; on the screw there is a nut, with bevel cogs, that engage in the cogs of a bevel wheel, on a crank shaft. The whole is arranged within a case, in the usual manner. The side bars not only steady the jaws, but, at the same time, prevent the screw from being turned by the nut.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the claw-screw, rod, and slide bars, as above described, and for the purpose herein set forth."

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18. For a *Machine for Cleaning Buckwheat;* Daniel Pease, Jr., Floyd, Oneida County, New York, July 14.

This machine consists of a horizontal cylinder, within a concave. The surface of the cylinder is provided with wedge-formed rubbers, with plates between them, and at the end there is a section of a many-threaded screw, the concave being made to correspond to the cylinder, for the purpose of forcing the grain in and through, between the concave and cylinder, the concave being armed with flutes, teeth, &c., to make friction.

Claim.—"That which I claim as my invention, and desire to secure by letters patent, is—

"1st. The section screw, to drive the grain lengthwise the cylinder, in combination with the wedge-like rubbers.

"2d. The manner of setting the wedges on the revolving cylinder, to give friction to the grain.

"3d. The screw formed in the outside cylinder, to force the grain lengthwise of it, in combination with the wedge-like rubbers.

"4th. The arrangement of a slide to regulate the pressure of the grain in the cylinder."

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19. For an *Improvement in the Water Wheel, called the "Double Centre Vent Water Wheel;"* Wm. March, Sandbank, New York, July 14.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar form or curve which I give to my buckets, as herein described and represented; the outer end or lip thereof being curved inwards, or towards the centre of the wheel, the middle portion having the form of a very flat ogee, and the inner end being straight, and tangential to the inner circumference of the ring of the wheel."

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20. For *Improvements in the Safe Lock;* W. E. Woodbridge, New York, July 14.

Claim.—"What I claim, and wish to secure by letters patent, is—

"First. The interposing of a set of tumblers, substantially as herein described, between ordinary check tumblers and the key, in such a manner that, when acted on by the key, they shall raise their corresponding check tumblers to their proper height, and having tongues so related to a stump, attached to the lower side of the bolt, that they, (the interposed tumblers,) must descend after the full action of the key upon them, in order to allow either the bolt to pass, or the upper stump of the bolt to touch the tongues of the check tumblers, which arrangement also prevents the motion of the interposed tumblers, when, in an attempt to pick the lock, the upper stump is in contact with the tongues of the check tumblers.

"Second. The down tumblers, arranged with reference to the tumblers, so as to dispense with the use of springs, or other parts, to return the check tumblers to their original position, after projecting the bolt either outwards or inwards."

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21. For an *Improvement in the Chimney Cap;* William S. Burch, Washington, D. C., July 14.

The patentee says,—"The great difficulty heretofore experienced in the construction of chimney caps, has been to prevent smoking, in any state of the atmosphere. Several caps have been found efficacious in windy weather, but are worse than nothing, if applied to the top of the chimney in a calm, and, at such times, actually impede the draught. Others, again, may answer in certain states of the weather, but not in others. By my improvement, I can cure the worst case of smoky chimneys, and in all states of the weather."

Claim.—"Having thus fully described my improved cap and its mode of operation, I wish it to be understood that I do not claim as new, the application of conical caps to the tops of chimneys in many

different ways; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the inclined conical tube with the revolving chimney cap, substantially in the manner and for the purpose herein set forth."

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22. For an *Improved Mode of Teaching Children the Fundamental Rules of Arithmetic, by means of Tables arranged on Rollers, called the "Rotary Multiplication, Addition, and Subtraction Tables;"* Benj. M. Vanderveer, Clyde, New York, July 14.

Claim.—"What I claim as my invention, is the form of these tables, and the operation of bringing together the figures or numbers to be multiplied, added, or subtracted, and the novel manner of showing, not only the particular product, but a series of different products, at one and the same time, through the holes, giving the pupil the advantage of eleven results before his eyes, without confusion or distraction; and, in the language of an eminent teacher who has examined the tables, 'relieving the young learner from the tedium and irksomeness with which the knowledge of the combination of simple numbers has been heretofore burdened.'"

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23. For an *Improvement in the Fastenings for Window Blinds and Shutters;* Samuel Lichtenthaeler, Litiz, Pennsylvania, July 14.

On the hinged edge of the shutter there is a plate, provided with cogs, that engage with the cogs of a wheel, on the end of a spindle, that passes through the window frame to the inside of the house, so that, by turning the spindle, the shutter is closed or opened; and on the spindle there is a helical spring, which forces a bolt into a notch in the plate, at the appropriate time for fastening or holding the shutter in the required position.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the principle of opening and shutting, and holding firmly in any desired position, from the inside of the room, outside window shutters, or blinds, by the before described combination of the shaft, cogged wheel, spring, and cogged plate, constructed, arranged, and operated in the manner and for the purpose set forth."

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24. For an *Improvement in the Mode of Manufacturing Wrought Iron Nails, for Horse Shoes:* Jedediah Holcomb, Brandon, Vermont, July 14.

We are under the necessity of omitting the claims, as they refer to, and could not be understood without, the drawings.

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25. For an *Improvement in Locks for Doors, Safes, &c.;* David M. Smith, Springfield, Vermont, July 14.

To the upper surface or edge of the tumbler, of the usual construction, there is a bar that may slide vertically, on two screws that pro-

ject vertically from the tumbler; and above the spring bar, are arranged a series of cams, each on a separate arber, so that, when so turned that their lesser diameter is towards the spring bar, the tumbler can be lifted to open or close the bolt, but when they are turned in any other position, the bar prevents the tumbler from being lifted up to free the bolt.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the spring bar with the cams, &c., and spring lever; the whole being applied to the main bolt, and made to operate together substantially as above specified."

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26. For *an Improvement in the Threshing Machine;* Jesse Fitzgerald, New York, July 14.

We omit the claim in this instance, as it could not be understood without the drawings to which it makes reference.

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27. For an *Improvement in the Hot Air Stove;* Eleazer D. Loveland, City of New York, July 14.

This hot air furnace consists of six concentric cylinders with the fire chamber at the bottom, and in the second from the outside, the lower end of the four inner ones being above the fire. The products of combustion pass up from the fireplace between the second and third cylinders, (counting from the outside,) down between the fourth and fifth, and up to the chimney through the sixth or inner one, while the air to be heated enters at the bottom between the outer and the second cylinders, down between the third and fourth, and up between the fifth and sixth to a drum, from which it is to be conducted to the apartments to be heated.

Claim.—"Now, I do not claim, in the foregoing description of my improvement in hot air stoves, having any originality in the arrangement of the fire plate under the hot air flues, nor the damper for governing the direct draught, they being of common use in most hot air stoves: but what I do claim, and wish to secure by letters patent, is the manner herein described of combining the six cylinders and flue spaces, by which a greater extent of heating surface, for the purpose herein set forth, is obtained.

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28. For *Improvements in Machinery for Spinning Hemp;* John McCully, Salem, Massachusets, July 14.

Instead of giving a traverse motion to the bobbin or flyer to distribute the thread on the bobbin, there is an annulus or ring for guiding the thread that slides on the arms of the flyer, and receives its motion by means of a vibrating carriage provided with guide rollers in which the periphery of the annulus runs. The spindle of the bobbin is provided with a double friction pulley, so that, by means of a lever and regulating screw, the friction can be increased or diminished at pleasure to regulate the twist of the yarn, and as the motion of the annulus in one direction produces a drag on the yarn and not in

the other, which would result in producing an uneven thread, this is obviated by connecting the lever of the friction pulley with another lever that is acted upon by a semi-circular cam, so that during one-half of the operation the friction pulley retards the motion of the bobbin.

Claim.—"Having thus fully set forth my invention, that which I claim is the annulus, in combination with the flyer and carriage beneath it, the whole being constructed and operating substantially in the manner and for the purpose as described.

"I also claim the combination of the fixed and rotary friction disks and lever, and its regulating screw, as the same is applied to the bobbin spindle and frame, and made to operate substantially as specified.

"I also claim the lever, and semi-circle or cam, in combination with the lever of the disk, the same being for the purpose as described."

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29 For an *Improvement in Lamps;* Theodore F. Strong, City of New York, July 20.

The patentee says,—"The nature of my invention consists in taking an ordinary glass night lamp, when in the process of making at the glass blower's, and depressing the top, where the wick tubes are inserted, downwards, in such a manner as to elevate the sides some one or more inches above the top of the wick tubes when inserted."

Claim.—"In the construction of this lamp I do not claim the invention of any new material of which the lamp is made, nor the mode of using the socket and wick tube by inserting it into a cup of oil; but what I do claim as my invention, and wish to secure by letters patent, is the peculiar form which I give to the lamp cup: that is, by depressing the top of the lamp cup where the wick tubes are inserted downwards in such a manner as to elevate the sides of the cup some one or more inches above the top of the wick tube, and thereby surrounding the flame of the lamp with a transparent shield; for, when a lamp cup is depressed in the centre in this manner, it forms a hollow rim around the sides and top of the lamp, which is intended as a protection against the numerous accidents occurring everyday by oversetting of lamps and spilling the oil, or setting on fire articles coming into contact with it when overset. In this lamp, instead of the oil, when overset, running out at the vent holes, or the top, (or the socket, should it fall out,) the oil runs into the sides, which, being large enough to hold all the oil, prevents any spilling, and at the same time surrounds the flame."

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30. For *Improvements in the Combination Lock;* John L. Whetstone, Cincinnati, Ohio, July 20.

The patentee says,—"In my combination lock I adopt the well known principle of permutation, there being any desired number of movable bits to the key which are to act upon a corresponding number of tumblers, which slide up and down vertically within the lock. A principal improvement in my manner of constructing the safety

lock consists in my managing and combining the tumblers and the bits of the key, so that the tumblers may either be raised or drawn down, or in part raised or in part drawn down by the action of said bits.

The box of my lock I divide into two separate chambers by inserting a partition plate of the same width and length with the cap plate, midway between the cap plate and the face plate of the box, thus forming what may be denominated the anterior and posterior chambers. When the key is inserted for the purpose of moving the bolt, it is passed first into the anterior chamber, and is then turned partially around until it arrives at a proper opening through the division plate, where it is made to enter the posterior chamber and to operate on the bolt.

Claim.—"Having thus fully described the manner in which I construct my lock, and shown the operation thereof, what I claim therein as new, and desire to secure by letters patent, is, first, the manner in which I have arranged and combined the tumblers and the key, so as to allow the tumblers to be moved either up or down, by reversing them upon the racking stump, and by causing the bits of the key to act upon the upper and lower curve of said tumblers, substantially as herein set forth.

"I also claim the manner in which I have arranged and combined the revolving escutcheon and the bridge plate, the box of the escutcheon being adapted to the arm of the key, and to the bridge plate, in such manner as that, by the aid of the slot or opening, in said box, the arm of the key is allowed to pass between the bridge plate and the division plate, for the purpose and in the manner set forth."

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31. For an *Improvement in the Door or Gate Spring;* Jacob Shaw, Jr., Heinckley, Ohio, July 20.

This improvement consists in connecting by means of a joint link one wing of a common butt hinge with a spring attached to another wing made of greater length than usual.

Claim.—"I do not claim, *generally*, attaching a spring to a door or hinge in such a manner as to perform the double office of closing the door and forcing it open, according to the position of the door, this having already been done; but what I do claim is the particular manner in which I have arranged the spring or weighted lever, in combination with the door or hinge, for the accomplishment of that object."

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32. For an *Improvement in the Carding Engine;* M. W. Obenchain, Springfield, Ohio, July 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the additional doffing roller between the two main carding cylinders, for the purpose of taking the fibres from the first main carding cylinder and transferring them to the second, with more regularity than heretofore, as described; and in combination with this, I also claim the stripper which works be-

tween the two doffers, and which transfers the fibres from them to the second main carding cylinder, as described. And, finally, I claim the employment of two roll-doffers, with longitudinal fillet cards, arranged substantially as herein described, whereby a much greater number of rolls can be made in the same space of time, and of better quality, than with the single doffer, in consequence of the regular action on the carding cylinder."

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33. For an *Improvement in the Machine for making Hat Bodies;* Russel Wildman, Hartford, Connecticut, July 20.

The patentee says,—"My arrangement consists in feeding the stock of fur, wool, &c., after it is properly prepared upon a common feed apron, in sufficient quantity to form a hat body of the desired heft, and thus feeding it through rollers which hold it firm, yielding it in small proportions to the rotary picker cylinder. The stock is thrown by the picker through the case divided longitudinally by two adjustable partitions on to a metallic perforated cone, placed near and in front of the tubes beneath the picker, as an aperture for the admission of a current of air to aid in carrying the stock through the tubes. The cone rests upon a revolving stand and thereby has a revolving motion whilst the body is forming thereon. Through the centre of the revolving stand is an opening connecting the inner surface of the cone with a trunk that is connected to a fan-blower by which the air within the cone is partially rarified causing a rush of air from all directions to and through the apertures of the cone, carrying the stock on to and holding it thereon in order to lay the stock in the desired proportion upon the cone, the tubes through which the stock is conducted, vary in height. The tube designed to form the brim spreads the stock from the base of the cone as high as the band of the hat. The second from the base of the cone to the square of the hat, a third from the base to the tip of the cone; an extra square is formed to the body by enlarging the second tube a little at top.

Claim.—"What I claim to be new and my invention in the above described machine, and desire to secure by letters patent of the United States, is the tube, (which conducts the stock to the cone,) divided longitudinally by adjustable partitions, for the purpose and in the manner substantially as herein described."

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34. For an *Improvement in the Carpet Loom;* William Sherwood, Ridgefield, Connecticut, July 20.

The claims refer throughout to the drawings, and could not be understood without them; and therefore we are under the necessity of omitting them.

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35. For an *Improvement in the Shifting Cam Loom;* Richard Garsed, Frankford, Pennsylvania, July 20.

The patentee says,—"In the weaving of twilled fabrics it is known that the sets of harness have to be shifted in succession whether con-

sisting of three or more, commencing with the first, then the second, then the third, &c., and back again to the first: this has generally been done by a series of cams, one for each treadle, requiring the cam shaft to move very slowly and rendering an additional cam shaft necessary either for the harness cams or the shuttle cams. To obviate this I make the harness cams to slide endwise on the shaft, and provide them each with a cylindrical hub, the periphery of which has as many grooves cut in it as there are treadles to be worked by it in succession, these grooves run in the direction of the circumference nearly the whole circuit, but towards the end the first takes a diagonal direction and runs into the second, and in like manner the second into the third, and the third then crosses the second and runs into the first; the inclination of the grooves uniting the third and first and crossing the second, being greater than that which unites the first and second, and the second and third. These grooves receive a feather which turns on a stud pin projecting from the frame, so that as the cam shaft rotates, (supposing the feather to be in the first groove), the first groove runs on the feather, and when it becomes diagonal, to run into the second, the feather turns on the stud and runs into the second groove, thereby shifting the cam to the second treadle. In like manner it is shifted to the third, and then back to the first, the ends of the turning feather being rounded to prevent catching on the fillets between the grooves where the third groove crosses the second to run into the first."

Claim.—"I do not claim as my invention, simply giving a reciprocating motion, by means of a grooved cylinder, as that has been frequently done in mechanics; but what I do claim as my invention, and desire to secure by letters patent, is shifting the cams of looms by means of three or more grooves, running back into the first, and crossing the others, while the cams do not touch the treadles, in manner and for the purpose substantially as herein described."

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36. For an *Improvement in Locks for Carriage Doors, &c.;* James Ives, Hampden, Connecticut, July 28.

The patentee says that his invention consists—"First, in casting the lock case in one piece, with the exception of one of the side plates; second, in making the bolt with a journal on one face only; third, in securing the spindle of the handle in its place, by making it with a projection on the inner end, which, after passing through a groove in the bolt, and a corresponding one in the lock plate, on that face of the bolt which has no journal, and then turning the spindle partly around, is retained by the lock plate; and, fourth, making this last mentioned plate with cam-like projections, and providing the spindle with a spiral spring, the tension of which draws the projection on the inner end of the spindle towards the plate, and causes the spindle and bolt to turn around in either direction, from the highest part of the said cam-like projection, on which the projection slides."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the spindle with a projection on the inner end, that bears on the outer face of the lock plate, when this is com-

bined with a bolt made without a journal on one face, or with a journal that does not pass entirely through the lock plate, or is of less diameter than the projection on the spindle, as described; and this I also claim, in combination with the cam or cams on the face of the plate, whether one or two journals be used, substantially as herein described, whereby a spring acting on the bolt is entirely dispensed with, as described."

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37. For an *Improvement in Constructing Cisterns for Water;* Jacob Peebles, Concordia, Louisiana, July 20.

Claim.—"Having thus fully described the nature and object of my improvement in the manner of constructing cisterns in alluvial or wet soil, what I claim therein as new, and desire to secure by letters patent, is the combining of the conical form of the sides thereof, with the inverted dome bottom, in the manner and for the purpose herein fully made known. I do not claim either the conical sides or the inverted dome bottom alone, their combined action being necessary to the attainment of the end desired, and it will be manifest that, in making this claim, it is not a claim to a mere change of form, but to one that is necessary to the attainment of an important and very useful result."

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38. For an *Improvement in the Wheat Fan;* Jacob Shermer, New Valley, Maryland, July 20.

We omit the claim in this instance, because of its dependence on the drawings, but it is simply limited to a method of arranging parts for combining the rock shaft and the shoe.

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39. For an *Improvement in the Machine for Doubling, Twisting, and Reeling Yarn;* George Levan, Gap, Pennsylvania, July 20.

The patentee says,—"In the machines heretofore employed for this purpose, the single yarns are taken either from bobbins or reels, and two, three, or more threads passed through a flyer, which twists and winds them on to a bobbin, and then, by a second operation, reeled to form skeins. The object of my improvement is to perform the three operations of doubling, twisting, and reeling, all at once, which I effect, by taking as many bobbins as there are to be single threads in the compound thread, and placing them on pins in a disc, attached to a spindle, and at equal distances around the centre thereof, and passing all the threads through an eye at the upper end of the spindle, the rotation of which twists them all into one thread, which passes over guides, to a reel, to be wound into skeins."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the shipping of the apparatus, in combination with the reel, for the purpose of throwing the machinery out of gear, when the skeins are of the proper size, as described."

40. For an *Improvement in the Mode of Making Fences;* Joseph Stevens, Northumberland, New York, July 20.

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is the mode of combining the wooden panels with the posts, (constructed of clay or other suitable material,) substantially as herein set forth, so that the rails shall be permanently secured to, and suspended on, the posts, (which are placed diagonally in the fence,) by the top rails, that rest upon, and are affixed to, caps on the tops of the posts; the bottom rails being notched out at their ends, so as to embrace the posts, and the two rails being connected by the upright palings, as herein described, and for the purposes enumerated."

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41. For an *Improvement in Pencil Cases;* James Boss, Philadelphia, Pennsylvania, July 20.

The following claim will enable the reader to understand this improvement as clearly as we could describe it without drawings.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application to the pencil, (now in use,) of the combination described, to wit: the elongation of the cylinder, the increased length of screw, and particularly the box, to contain the leads, which will allow them to come out only one at a time, through the point alone, and that by so slight an exertion, as to be styled 'a self-feeding ever-pointed lead pencil;' and I do hereby disclaim the former invention, now in use in the common lead pencils."

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42. For an *Improvement in the Steering Wheel;* R. C. Holmes & J. J. Springer, Cape May, New Jersey, July 20.

The patentees say,—"The nature of our invention consists in the employment of two grooved rollers, mounted in appropriate bearings, one above the other, on the helm, the upper one being on the shaft of the tiller wheel; and mounting the tiller rope, by first attaching one end of it to one side of, and near the extremity of, the helm, passing it through a block attached to the side of the vessel, then through a block attached to the same side of the helm, then over the upper drum, and in the first groove, then under the lower drum, then around the upper drum, and in the second groove, then around the lower drum, and in the second groove, and so on to the end, each time crossing the rope, to insure the bight thereof, and then from the upper drum to a block attached to the side of the helm, and just opposite to the attachment of the rope, on the other side, and thence carrying the rope through a block at the side of the vessel, and then tying the ends to the helm, at a point just opposite to the block on the other side; so that, by this arrangement of the grooved drums, and the disposition of the tiller rope, it, (the rope,) is prevented from slipping and overriding, and, at the same time, it is prevented from making slack, as the helm vibrates, for the slack is taken up on one side as fast as it is made on the other, and the rope is also prevented from chafing."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of the two grooved rollers, geared together for the purpose of preventing the rope from slipping, as described, in combination with the arrangement of the tiller rope, by having it on either side connected with the helm at two points, and also passing through a block on each side to the vessel, as herein described, whereby the making of slack, by the vibration of the helm, is avoided, as described."

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43. For an *Improvement in the Machine for Cleaning Clover Seed;* Daniel Hoats, Mifflinburg, Pennsylvania, July 20.

Claim.—"Having thus fully described my improvements, I wish it to be understood that I do not claim as my invention, the forming the cylinder in triangular ribs, or in separate rings, merely: but what I do claim as my invention, and desire to secure by letters patent, is the combination of the pyramidal teeth with the triangular ribs, as above described."

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44. For an *Improvement in the Mode of Warming the Inside of Railroad Cars;* Tappen Townsend, Albany, New York, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application, to railroad passenger trains, of the combination of the flues, connected by the elastic and flexible hose, with the openings and registers in the bottoms of the cars, as described herein, reference being also had to the accompanying drawings."

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45. For an *Improvement in the Portable Grain Separator;* Elizur L. Booth, Canandaigua, New York, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"First. The screen, in its peculiar construction with rods, wires, and rough surface, in the manner described, thereby securing the jarring motion, and combining simplicity, cheapness, and efficiency in execution.

"Second. Keeping the return belt spread, by means of conical pulleys, instead of slots, and giving it motion in the direction described, to return the grain back again to the fanning mill. I claim its peculiar construction and motion, in combination with the open revolving screen, and not otherwise.

"Third. Projecting the separating concave over the revolving screen, in combination with the arrangement of the shoe.

"Fourth. I also claim the combination of the extra fan, with the screen and return belt, and its position under the belt, to break the current of air produced by the screen and return belt, and not otherwise."

46. For a *Machine for Digging Potatoes;* Allen Eldred, Oppenheim, New York, July 24.

The patentee says,—"The nature of my invention consists in the employment of a scoop, with the sides curved up, and the forward part with a point in the middle, and an oblique cutting edge on each side, extending from the front to the top of the curved side, the scoop being provided with a standard, rising from the middle of it, to form the connexion with the beam. And to this scoop is jointed a plate, with long projecting inclined fingers, or rods, on to which the potatoes and earth, dug up by the scoop, are discharged, so that the earth may drop through the spaces between the teeth or fingers, whilst the potatoes are forced up the inclined plane formed by the fingers, and are discharged above the surface of the earth, to be readily gathered.—The plate from which these fingers project, is connected with the scoop by means of a single bolt, on which it vibrates, by means of tappets or cones, on the faces of a wheel, to shake the earth, and facilitate the separation of the potatoes therefrom."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the inclined fingers, in combination with the scoop, for the purpose and in the manner substantially as herein described. And I also claim giving to the fingers a vibratory motion, the better to separate and discharge the earth, substantially as herein described."

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47. For *Improvements in the Apparatus for feeding Nail Plates to Nail Cutting Machines;* Amos L. Reed, Pittsburg, Pennsylvania, July 24.

The nippers that hold the nail plate are on the end of a spindle, that is pushed towards the cutters, by the gradual winding of a cord attached to its rear end. This spindle slides freely through a sleeve, that turns freely in a frame hung upon trunnions, so that at the end of each cut, an arm is lifted, by a cam on the main shaft, to lift the frame, that the nail plate may be lifted from the bed cutter, preparatory to turning it over, which is done by the same cam, that vibrates a sector arm, connected, by two belts on opposite sides, with the rotating sleeve, so that the vibration of the sector arm, gives half a revolution to the sleeve, and also to the spindle that carries the nail plate.

Claim.—"Having thus fully described the nature of my improvements in the apparatus for feeding nail plates, what I claim therein as new, and desire to secure by letters patent, is the manner herein described, of combining the apparatus for withdrawing and turning the nail plate, with that for raising the feeder; this being effected by an arrangement of parts substantially the same with that herein fully made known."

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48. For an *Improvement in the Washing Machine;* Joseph Greenleaf, North Yarmouth, Maine, July 24.

Claim.—"Having thus fully set forth my invention, I wish it to be

distinctly understood that what I claim, is the confining apron, in combination with the main cylinder of slots, and the fluted rollers over the same; the whole being arranged, and made to operate together, and upon the articles to be washed, substantially as herein before specified."

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49. For a *Safety Lock;* James Atwater, New Haven, Connecticut, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of a sliding plate of hardened steel, or other material, constructed and operating substantially as herein described, to the outer plate of any lock for chamber or other doors, (which require to be locked on either side, at the option of the occupant of the apartment,) so as to close the key hole on the outside by the operation of the key, as described, when the door is locked from within, and thereby render it impossible for the lock to be picked from the outside, even with the aid of the proper key; while, when the door is unlocked, it may then be locked and unlocked from the outside, the same as any common lock, without operating on the sliding plate, as herein described.

"And I hereby disclaim all and singular, the other parts of the lock, as heretofore known and used."

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50. For an *Improvement in the File for Filing Metals;* Richard Flint, Meriden, Connecticut, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a round file, cut by means of a right and left hand screw or screws, substantially as above set forth."

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51. For *Improvements in the Electro-Magnetic Fire Alarm;* Addison Smith, Perrysburg, Ohio, July 24.

The patentee says,—"These effects are produced by galvanic agency, the galvanic fluid being supplied by a constant battery, formed by burying in the moist earth, a sufficient surface of positive and negative metals. The circuit of this battery is formed by an insulated copper wire, passing from one pole of the battery to the other, thence returning to the former pole through the moist earth."

Claim.—"Having thus fully described the manner in which I construct, arrange, and combine the respective parts of my electro-magnetic fire alarm, I do hereby declare that what I claim as new therein, is the manner herein described, of constructing what I have denominated the connecting apparatus. And I likewise claim the combination of the connecting with the designating apparatus, arranged and operating as herein described; not intending, however, by this claim, to limit myself to the precise form of the respective parts as represented, but to vary these as I may deem expedient, whilst I attain the same end by means substantially the same."

52. For an *Improvement in the Town or Turret Clock;* Charles F. Johnson, Oswego, New York, July 28.

Claim.—"Having thus fully described the nature of my improvements in the manner of constructing town or turret clocks, and shown the manner in which I arrange and combine the respective parts thereof, what I claim therein as new, and desire to secure by letters patent, is the giving motion to the parts of such clocks as are concerned in carrying the hands, and in striking the hours, by the employment of a small timepiece, which is to raise a light hammer, and to allow it to fall at determinate intervals, and, by its momentum, to disengage a pendulous body, or pendulum, connected with the hands and other parts of the dial work, substantially in the manner herein set forth. I also claim the manner of operating the striking parts of such clocks, by the action of a hammer, at the end of every hour; said hammer being operated upon by means of the apparatus that governs the motion of the hands, and substantially as herein described; it being understood that the numbers herein given are not absolute, but relate to proportion only.

"I have already stated that turret clocks, so constructed, may be made at half the cost of those in general use; but, besides the point of economy, they are more accurate than others, as, the timekeeper being entirely detached from the apparatus which moves the hands, the powerful action of the wind on said hands has not the slightest influence on the rate of going."

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53. For an *Improvement in the Smut Machine for Cleaning Grain;* H. D. Reynolds, Mill Hall, Pennsylvania, July 28.

Claim.—"I wish it to be distinctly understood, that I do not make claim to a set of beaters, connected with the shaft by arms at each end, instead of closed ends or heads; nor do I claim making a cylindrical covering or case with wire gauze, and opened or wire gauze ends, as these separately have long since been known; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the rotary beaters, with open ends, in combination with the wire gauze ends of the case or covering, for the purpose of admitting a current of air at each end of the machine, to equalize the action of the beaters on the grain, throughout the length of the machine, and more effectually to discharge the impurities, as described."

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54. For an *Improvement in the Escapement for Watches;* Charles E. Jacot, New York, July 28.

Claim.—"I do not claim to have invented a new watch; but I do claim as new, and of my own invention, and desire to secure by letters patent, the application of a roller on the balance staff made of ruby or agate, or other proper material, fitted with a groove to take the end of the lever, and the combination therewith of a crown or contrale wheel, fitted or constructed with conical teeth having radial

axes, and acting conjointly with pallets fitted to coincide with the wheel teeth; the whole constructed and operating substantially as described."

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55. For *Improvements in Locomotive Steam Engines;* Ross Winans, Baltimore, Maryland, July 28.

Claim.—"Having thus fully set forth the nature of my improvement, what I claim and desire by letters patent is the employment of wheels of small size, as above mentioned and described, with wrought or soft iron flanches, in combination with an engine having six or eight driving wheels with axles, parallel to each other, and accommodating itself to curves and turnouts, by any of the devices or modes herein described for that purpose, and having the power applied to all the axles by connecting rods and cranks."

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56. For an *Improvement in Chairs;* Jonathan Knowles, Lowell, Massachusets, July 28.

The patentee says,—"The peculiar nature of my improvement consists in making the legs of a child's chair to fold down upon or against the bottom thereof, in order that the said chair may be applied to a truck or carriage whenever circumstances may require the same.

Claim.—"Having thus set forth my invention, I shall claim the manner in which I am enabled to adapt a chair to a carriage or truck, or another chair, as above set forth; the same consisting in combining with the bottom of said chair the stationary cleats and folding legs applied to them as above described."

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57. For an *Improvement in Sleighs;* Moses Miller, Fort Ann, New York, July 28.

Claim.—"Having thus fully described the manner in which I arrange and combine those parts of my sleigh in which my improvements are found, what I claim therein as new, and desire to secure by letters patent, is the within described manner of combining the dash board with the raves or frame work of the sleigh; the dash board being affixed on the outside of the raves, thereby admitting of its being widened out so as to constitute wings, whilst under the peculiar arrangement set forth it may be disconnected for the purpose of repair, and replaced at pleasure. To this manner of combining the dash board with the raves I limit my claim."

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58. For *Improvements in the Machine for Making Spikes;* William Hatch, Medford, Massachusetts, July 28.

We have to omit the claims in this instance on account of their reference to, and dependence on, the drawings. The general character of the invention will be understood from the following extract from the specification, viz.—"My machine is calculated to perform upon a heated rod of metal, the operations of dividing or cutting it off into

lengths necessary to form spikes, of rolling and pressing down two opposite sides of each of said lengths to an angular point, of forming a head upon the end of each length, opposite to that on which the point is performed, and finally discharging the spike (when thus completed) from the machine."

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59. For an *Improvement in the Hot Air Stove;* Evans Backus, Brooklyn, New York, July 28.

The patentee says,—"It has long been considered a desideratum in stoves for heating apartments, to form them as compact as possible, while at the same time air is brought into contact with the greatest convenient amount of heating surface, by which economy and comfort are combined. By the construction which I have invented (as hereafter described) I have a compact pedestal or conical stove without any exterior flues, side pipes, or heaters, while a rapid and constant circulation of the air of the room is secured in contact with the heating surface."

Claim.—"Having thus fully described my improvement, what I claim as my invention, and desire to secure by letters patent, is the descending and ascending flues of the stove and air chamber in the manner described, and surrounded by a case, substantially as herein set forth."

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60. For an *Improvement in Fish Hooks;* Theodore F. Engelbrecht & G. F. Skiff, New York, July 28.

This improvement consists in jointing to the stem of a fish hook another hook which is forced down by a spring. When set for fishing the extra spring hook is held up by a sliding catch connected with the line, and when the main hook that carries the bait is pulled by the fish, this liberates the spring hook, which catches on to the fish.

Claim.—"What we claim as our invention and desire to secure by letters patent, is the construction of a self-acting spring and slide lever hook for catching fish, constructed as above described; and whether spiral or other springs are employed, or whether the lever is made to descend by being disengaged from a slide, operating as herein described, or by any other analogous process. We also claim the invention of a hook for catching fish, operated by a spring, a lever, and a slide, whether working as described above, or in any other way."

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61. For a *Machine for Cutting Screw Bolts;* Smith Groom, Troy, New York, July 28.

Claim.—"What I claim and desire to secure by letters patent, is the arrangement of nuts or bolts, or either of them, in such manner that while the cutting tool, attached to one end of the shaft, retraverses the thread of the nut or screw last cut, it necessarily forces the cutting tool at the opposite end up to, and makes it operate upon, the bolt or nut next to be cut."

62. For an *Improvement in the Yoke for Working Horses;* E. H. Danforth, July 28.

Claim.—"What I claim as my invention, and wish to secure by letters patent, is, first, the connecting of the whiffletrees and eveners with the hames, in the manner above stated, thus attaching them to the necks and shoulders of the horses.

"Second. The manner of attaching the whiffletrees and eveners to each other, and the latter to the bar, so as to produce the motion, as above described."

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63. For making *Tyre for Railroad Wheels;* D. Saunders, of Cincinnati, Ohio, J. G. Bisset, of Covington, Kentucky, and S. Saunders, of Pittsburgh, Pennsylvania, July 28.

The following is the mode of procedure:—A pile of iron and steel is made as follows; first a large bar of iron, then a thin bar of steel, then another bar of iron, the latter being thin, and serving only as a protection to the steel from being burnt in the process of welding, the whole is then welded. The bar is then passed through a series of rollers giving the required shape to the tyre, shrunk on to the wheel, and the thin plate of iron turned off to expose the steel to the surface.

Claim.—"What we claim as our invention, and wish to secure by letters patent, is the manufacturing tyre for railroad wheels, as herein described."

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64. For an *Improvement in Veneering;* T. R. Hibbard, assignee of Augustus McBurth, New York, July 28.

"The nature of my invention consists in interposing between the veneers, or veneer and body to which it is to be attached or united, or layers of wood to be united, a cotton or linen canvass, or other cloth, (the cloth and parts of the wood to be adjoined being first covered or prepared with glue or other adhesive material,) and then placing the parts to be united in juxtaposition; the cloths prepared as aforesaid being interposed, and uniting them by any of the known or suitable modes of compression. The cloth thus interposed adheres firmly to every part of the adjacent wood, and prevents the veneer from splitting or cracking with the grain of the wood, or leaving the body to which it is attached; renders two veneers minutely thin, thus united, stronger and more durable than if united in the usual mode, and than solid wood of many times its thickness or size.

"This invention is peculiarly adapted to the veneering or formation of unequal surfaces, or to cases where the veneering wood is required to be bent or compressed out of its natural inclination. It is especially adapted to the construction of wooden tubes or pipes. The mode I adopt in the constructing of tubes or pipes is the following: A veneer or layer of wood is first rolled around a rod or shaft attached to a crank, and turning with it and compressed by a cord, (I have used,)

or other compression, into the required shape. The cloth, saturated with glue or other adhesive substance, is then rolled tightly around the veneer thus shaped as above, and then another veneer, or layer of wood, is applied upon the cloth and compressed, by the means above stated, into contact with every part of the cloth; by turning upon which, the veneers are shaped or rolled over a furnace, and the glue or adhesive matter is made to penetrate every part of the fabric."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use or application in veneering or uniting layers of wood, of linen, cotton, canvass, or other cloth, covered or prepared with glue or other adhesive substance interposed between the veneers or layers of wood to be united, or veneer or body to which it is to be united, substantially as described, whether this be employed for making tubes or pipes, constructed as above, for the purpose to which they may be suited or applicable, or to any other purpose."

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65. For an *Improvement in the Surveyor's Compass;* Samuel Kern, Strasburg, Virginia, July 31.

The patentee says,—"The surveyor's compass has heretofore been an expensive instrument, and one difficult of adjustment and use, but my construction and arrangement of the parts thereof renders it at once cheap and efficient, enabling one to use it as a compass for running lines or for leveling as may be required."

Claim.—"Having thus fully described my improvement, I wish it to be understood that I do not claim as new the dial-plate, the compass-needle, or the sights, as they have long been known and used, but in a different combination. What I do claim as my invention, and for which I desire letters patent, is the combination of the dial-plate, compass-box, and sights, in the manner set forth; the compass being placed under the surface of the dial, and the bar on which the sights are placed above it, so that it can have an entire sweep around the circle tangentially, in the manner and for the purpose described."

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66. For a *Machine for Preparing and Cleaning Potters' Clay;* S. Miller & G. Roller, Carrol county, Maryland, July 31.

This machine consists simply of a lever press, the follower of which is fitted to slide in a box that has a perforated bottom through which the clay is forced.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the principle of cleansing and tempering potters' clay, by forcing it through a sieve or screen, as herein described."

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67. For an *Improvement in the Corn Sheller;* Lorenzo B. Glover, Easton, Connecticut, July 31.

The object of this machine is to separate the corn from the cobs after it has been shelled; but as the drawings are very imperfect and

the specification covers some nine or ten folio pages, we will be under the necessity of omitting any further description.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"First. The open wheel, constructed as above described.

"Second. The arrangement of the bars and teeth upon the revolving wheel, by which the revolution of the cob is produced.

"Third. The arrangement of the teeth upon the lower surface of the upper wheel, by which the cob is permitted to escape from between the wheels when the corn has been disengaged from it."

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68. For an *Improvement in the Machine for Cutting Shingles;* Jonathan Bennet, Amenia, New York, July 31.

Instead of having one knife attached to a sliding gate to cut one shingle from a block at each operation, there are under this improvement two of them, one above the other, and reversed so that the first cuts the but from one end of the block, and the other follows cutting it from the other end. There is a spring rest which is forced back after the first shingle is cut to permit the first knife to pass.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar arrangement of the knives in combination with the gauge-plates and spring-rest in such way that their combined action shall effect the production of two shingles at one complete downward motion of the gate, cutting *both* from but to tip *without changing* the block or shingle bolt."

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69. For an *Improvement in the Boiler for Boiling Water;* Jason L. Burdick, Norwich, New York, July 31.

Claim.—"Having thus fully described the manner in which I construct my boiler, and combine it with a vat in which water is to be boiled, what I claim therein as new, and desire to secure by letters patent, is the particular arrangement and combination with the furnace of the water-heating tubes that pass through the furnaces; these tubes having the lateral tubes opening into them from the vat, by which a perpetual circulation of the water is obtained, and the tubes are prevented from being burnt out.

"I do not claim the combining of heating furnaces with vats, but I limit my claim to the particular device above set forth."

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70. For an *Improvement for holding up the Tail of a Horse after Nicking;* Gibbons Gray, West Chester, Pennsylvania, July 31.

Instead of attaching the horse's tail to the stall or roof, it is connected with a semi-hoop or bale attached to the back of a saddle, and this bale is in turn connected with the cantle of the saddle by means of springs, so that the same tension is kept on the tail in any position which the horse may assume.

Claim.—"Having thus described my apparatus and its mode of

operation, what I claim therein as new, and desire to secure by letters patent, is the apparatus constructed substantially as herein set forth, so as to be attached to the back of the horse, and serve to elevate his tail when he is in any position; arranged and combined in the manner and for the purpose set forth herein."

Improvements added to existing Patents during the month of July, 1846.

For an *Improvement in the Horse Hames;* Nathan Post, Porter, New Jersey, July 14, added to patent of June 5, 1844.

The patentee says,—"My new improvement consists in superseding the use of the levers which pass through the draught hooks, and which were coupled together by a strap and buckle, or chain and hook as specified in the schedule annexed to the aforesaid letters patent, and substituting therefor a more simple mechanical arrangement for performing the functions of said levers, which said levers in connexion with the draught hooks specified in the schedule before referred to, kept the hames in their proper position on the collar."

Claim.—"What I claim therefore as my invention and desire to secure, is the combination of the lever shoulder on the clips with the draught hooks and hames, the purpose and operation of said combination being substantially as above set forth."

List of American Patents which issued in the month of May, 1842, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

21. For an *Improvement in the Water Wheel;* Abijah Woodward Swanzey, New Hampshire, May 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the buckets and wings, in the manner described, with the penstock, having a ring and projection arranged as herein set forth."

The buckets project radially from a hub, with a curvature backward at their outer end, and, from their lower edges, wings are extended downwards, spirally, with an increasing curvature. To this wheel is adapted a penstock, having a ring, extending out over the rim of the wheel, and under the ends of the buckets.

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22. For an *Improvement in the Method of Propelling Boats;* Truman Cook, New York, May 12.

We are under the necessity of omitting the claim, as it could not be understood without the drawings to which it refers.

The general principle on which this propeller operates, is that of sculling. On each side of the boat there is a vibrating arm, having a

paddle at the end thereof, with a shifting fulcrum, so that the paddle shall act to propel the boat forwards, when the arm vibrates in either direction.

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23. For an *Improvement in the Spring Perch for Carriages;* Stephen Tomlinson, Bridgeport, Connecticut, May 16.

The patentee says,—"The nature of my invention consists in providing a spring perch, for carriages having elliptic springs, by which they can be constructed with less weight, with greater strength and durability, with an increased amount of spring, and the fifth wheel above the elliptic spring."

Claim.—"What I claim as my invention, and what I desire to secure by letters patent, is the application of a spring perch, as above described, to carriages of any size and description, which will combine the advantages above described, using, for that purpose, any material which may accomplish that purpose."

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24. For *Improvements in the Loom for Weaving Carpets;* Erastus B. Bigelow, Lancaster, Massachusetts, May 16.

The mechanism of this loom, including, as it does, some important modifications of the jacquard, is necessarily very complex, and, without a full description, the claims could not be understood, and therefore, we omit them; and this we do the more readily, as it is our intention to give, in a series of articles, a full account of all the improvements in the art of weaving, which have been patented in this country since the re-organization of the Patent Office, in 1836.

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25. For an *Improvement in the Plough;* Cornelius Bergen, Brooklyn, New York, May 16.

Claim.—"The improvement I claim as my invention, and desire to secure by letters patent, is, first, the peculiarity of the form of the mould board, as produced by the combination of the increased twist and wedge, the advantages of which are, that it materially lessens the friction, and consequently the traction or draught is much diminished; the scouring is more uniform on every part of it, which causes it to do its work in a superior manner. Second, the manner in which the point and share are formed, and held to the mould board, the peculiarity of their construction, and the manner in which they are held in their place, by means of the gripe, which enables them to be made of cast iron, instead of wrought, sufficiently strong for all purposes, and, consequently the annual cost is much cheaper. Third, the additional piece, to heighten the mould board when desired, the advantages of which are, that a second slice may be taken out of the bottom of a furrow, previously made, and cast completely above, which answers the purpose of trenching, as performed with a spade: it is also of great service when ploughing weedy ground; all as herein described."

26. For an *Improvement in the Grate for Open Fire Places;* James Easterly, Troy, New York, May 16.

Claim.—"Having thus fully described the nature of my improvement, in those grates which project out from the jambs in open fire places, what I claim therein as new, and desire to secure by letters patent, is the making the projecting ends, or sides of the body of such grates, of plates of metal, by which the said ends are closed, and air is admitted at the front of, and under, the fire only, in the manner and for the purpose herein set forth."

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27. For an *Improvement in the Manufacture of Glass Knobs, and other like articles;* William S. Thompson, of Cambridge, & A. C. Hobbs, of Boston, Massachusetts, May 20.

Claim.—"Having thus explained our invention, we shall claim protecting the gold or silver leaf, or foil, which covers that part of the glass inserted in the metallic socket, from injury, during the above described operation of cementing the parts together, by the japanning compositions, previously applied thereto, and indurated by heat, substantially in the manner, and on the principles above set forth.

"Also, protecting the leaf or foil by means of a covering of muslin, oiled cloth, or other suitable fabric laid and covered over the same, and having its outer surface covered with a coating of varnish, japanning, or other suitable material as described."

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28. For *Improvements in the Double Cylinder Printing Press;* Richard M. Hoe, New York, May 20.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the particular arrangement of the spiral or other springs, levers, pistons, and their appendages for arresting the momentum of the bed, the springs being placed on or near to the foundation or base of the machine, and being connected with the levers which receive the blow of the bed at either end, as its motion is about to be reversed, the whole arrangement and operation being substantially the same with that herein described.

"Secondly, I claim the manner herein set forth of combining and arranging the apparatus for raising and lowering the pressing cylinders; that is to say, I claim the manner of governing and regulating this motion by means of a pinion placed on the main driving shaft, and operating upon a wheel carrying a cam, which actuates a rocking piece, connected with toggle joints, or progressive levers that raise and lower the respective cylinders, alternately, through the intermedium of an apparatus arranged substantially in the manner herein fully made known."

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29. For a *Stay Truss or Umbilical supporter;* Maria P. Dibble, New York, May 20.

We cannot give the claim as it refers to the drawings, and could not

be understood without them; but it is limited to the combination of the belts and springs constituting the umbilical supporter with the corset.

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30. For a *Cut-off Valve for Steam Engines;* F. E. Sickels, New York, May 20.

As this invention is now extensively known and used, we will simply give the claims on which the patent is granted.

Claim.—"Having thus fully described the nature of my improvements in the apparatus for lifting and tripping the valves of steam engines, and of thereby cutting off the steam any required part of the stroke; and also of my improved apparatus for regulating the closing of the valves; what I claim therein as new, and desire to secure by letters patent, is, first, the manner in which I have combined and arranged the valve stem, the spring on the lifter, the adjustable sliding piece with its wedges or inclined planes, and their immediate appendages, so as to co-operate with each other, and to effect the tripping of the valves and the cutting off the steam, substantially in the manner set forth.

"I also claim the manner of regulating the closing of the valves and of effectually preventing them from slamming, by means of a water reservoir furnished with a piston or plunger attached at the lower end of the valve stem, and operating within an adjustable cup or secondary reservoir, so as to effect the purpose intended; upon the principle, and substantially in the manner herein made known and described."

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31. For an *Improvement in the Saw Mill, for sawing Felloes and other Circular Work;* Isaac Sheetz, Taney town, Maryland, May 20.

Claim.—"What I claim therein as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the two lower frames or platforms, and the carriage, so as to allow the upper platform to shift on the lower, and the centre of motion of the carriage to be changed, the same being effected in the manner and for the purpose herein fully set forth and made known."

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32. For an *Improvement in the Bee Hive;* D. H. Farnham, Litchfield, Connecticut, May 20.

The claim is limited to making the hives with sliding bottoms, and the honey boxes with sliding covers.

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33. For an *Improvement in the Tuyers for Forges;* William W. Snow, Oneonta, New York, May 20.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is constructing the connecting pipe, the seg-

ment of a curve, in combination with the changeable hoods made in the manner and for the purpose set forth."

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34. For an *Improvement in Matches;* George W. Carleton, Bath, Maine, May 20.

The patentee says,—"I take two pounds of Arabic or other viscid substance, and dissolve in as little water as possible, I then deposit in a bottle holding one gallon, one and one-fourth pounds of the best phosphorus, and add to it enough of my diluted Arabic to cover the same. I then immerse my bottle in hot water for the purpose of fusing the phosphorus, and when it becomes fused, I give the contents violent shaking in order to subdivide the particles of phosphorus: then, to prevent their re-union, I add the remainder of my Arabic, and mix by shaking. I then add to it a fulminating compound composed of the following articles, viz.: two pounds of sub-carbonate of potass, three pounds nitrate of potass, and one pound of sulphur, I then grind all the ingredients together in the manner of grinding paint, and put up for future use or exportation suitable for the same.

Claim.—"What I claim as my invention, and wish to secure by letters patent, is a paste for making friction matches of the materials herein described, thereby dispensing with the non-combustible ingredients of other ignitible compositions of matter, causing my ingredients to enter into the support of the combustion, and making use of so large a quantity of phosphorus, as is generally used, entirely unnecessary."

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35. For an *Improvement in the Mode of Regulating the Heat of Stoves;* Elisha Foote, Jr., Seneca Falls, New York, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the expansive and contracting power of a metallic rod by different degrees of heat to open and close a damper, which governs the admission of air into a stove or other structure in which it may be used; by which a more perfect control over the heat is obtained than can be by a damper in the flue.

"I also claim as my invention, the mode above described of setting the heat of a stove at any requisite degree, by which different degrees of expansion are required to open or close the damper.

"I also claim the combination above described, by which the regulation of the heat of a stove or other structure in which it may be used, is effected; and I also claim as my invention the mode above described of connecting the action of the metallic rods with the damper, so that the same may be disconnected when the damper shall have closed, and the heat shall continue to rise, &c."

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36. For an *Improvement in the Pneumatic Engine;* John R. Remington, Aberfoil, Alabama, May 26.

Claim.—"I do not claim to be the inventor of the principle of giv-

ing a reciprocating movement to a piston in a cylinder, by a vacuum and atmospheric pressure; but what I do claim as my invention, and which I desire to secure by letters patent, is the before-described combination of the exhauster with the fire box, air receiver, cylinders, and pistons, and the several valves, connecting rods, cranks, and elbows for opening and shutting the valves and operating the pistons, as herein set forth."

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37. For an *Improvement in the Door Lock;* G. M. Zahm, Lancaster, Pennsylvania, May 26.

This claim could not be understood without the drawings.

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38. For *Improvements in Looms for Weaving Carpets and other Figured Fabrics;* E. B. Bigelow, Boston, Massachusetts, May 26.

The reason for omitting the claims of this patent will be found at No. 24 of the present list.

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39. For *Improvements in the Instrument for Measuring for the Cutting of Garments;* P. F. L'Veret, Warrenton, Georgia, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction and combination of the morphographer in its different parts and its application to the measurement of the human body, and transferring said measurement to the cloth, thereby enabling the practical tailor to furnish his customer a body garment accurately fitted and adapted, in all respects, and in every instance, to the person."

Legal Decision by the Circuit Court of the United States, New York, before Judges NELSON & BETTS, *in the case of Tatham's patent for Lead Pipe Machinery.*

George N., Benjamin Jr., and Henry B. Tatham, *vs.* R. W. Lowber, Thomas Otis Leroy, and David Smith.

The motion for an injunction against the defendants in this case to restrain them from an infringement of a patent for lead pipe machinery, came up for argument on the 7th April inst. [1847.]

The plaintiffs claimed as American patentees under an assignment from C. & J. Hanson, the alien inventors.

The patent was resisted upon several grounds. Among them were

1st. Want of novelty of invention. The defendants cited the machines of T. Burr, J. Hague, B. Titus, G. W. Potter, Jesse Fox, and several others.

2nd. That the 15th sec. of the act of 1836, provides for a forfeiture of a patent if it can be proved "that the patentee, if an alien, at the time the patent was granted, had failed or neglected for the space of

eighteen months from the date of the patent, to put and continue on sale to the public, on reasonable terms, the invention or discovery for which the patent issued." It was contended that this provision applied to the American assignees and patentees,—and that in fact a forfeiture had occurred by such failure and neglect.

3rd. It was urged that a patent for this invention was originally issued in England; that it was first obtained in the U. S. in 1841, with a specification differing from the English patent; and that it had been surrendered and reissued in 1846 with a new claim differing from both.

4th. That the defendants, Leroy and Smith, were not the owners of the machine—but merely supplied the material and sold the product:

There were other points of minor importance, and all of them were denied by the plaintiffs. The argument occupied the court four days, For the plaintiffs, George C. Goddard, Charles O'Connor, and S. P. Staples, Esqs. For the defendants, William Curtis Noyes, and Daniel Lord Jr., Esqs.

The decision of the court was given on the 21st. inst., as follows:

"We are satisfied

1st. The specification of the patent to plaintiffs (reissued 16 March, 1846) claims as the invention a combination or arrangement of the parts of machinery described; by which pipe, with the operation of hydraulic pressure, is made with lead in a *set* or semi-fluid state.

2nd. That the machine used by the defendants is in substance the same as plaintiffs.

3rd. The patentees can legally take out the reissued patent for more than was described in the surrendered one, if it does not exceed the actual discovery when the first was taken out.

4th. The evidence satisfactorily establishes that the Hansons were the first and original discoverers of the combination or arrangement embraced in the patent.

5th. The patentees after the assignment of the right and the grant of the patent to them, took and held it, with all the privileges of an American patent, and the alien clause in the 15th sec. of the act of 1836, applies only to alien patentees, and not to American assignees.

6th. But even if the assignee takes the right with the limitation or condition of the alien, still the plaintiffs have satisfied the act. They need not prove that they hawked the article about for a market, and that they tried to sell it to any person. Those seeking to defeat the patent must prove the plaintiffs neglected or refused to sell for reasonable prices when application was made to them.

7th. The sales by the plaintiffs, and those they proposed, and offered, were of the invention or discovery within the meaning of the act.

8th. The proof is sufficient to charge all the defendants directly and indirectly with using the machinery and violation of the plaintiffs' right.

Let an injunction therefore issue." New York Cour. and Inq.

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of Patent granted to JAMES NAPIER, *of Shacklewell, for Improvements in Smelting Copper Ores. Patent dated July 20, 1846. Enrolled January 20, 1847.*

When the ore contains less than 20 per cent. of copper, and more than two parts by weight of sulphur, to four parts of copper, it is first to be calcined, and then melted in the ore furnace—the slag removed, and tapped into sand or water, in the usual manner. When the ore contains less than 20 per cent. of copper, and less than two parts by weight of sulphur, to four of copper, it is to be mixed with ore, containing excess of sulphur, until it is brought to the same proportion as the above or thereabouts; this is then also to be calcined and fused, as above described. But, when the ore contains more than 20 per cent. of copper, and not less than one part of sulphur, to four parts of copper by weight, the calcining and fusing above described may be omitted, and the ore proceeded with directly, according to the method hereinafter described.

The products in the first and second cases, and the ore in the third case, mentioned above, the patentee denominates "coarse metal." To every ton of this coarse metal is added, in the metal furnace, 56 lbs. of soda ash, containing about 50 per cent. of alkali, and 56 lbs. of slaked lime. and the whole melted together. When fused, the slag is to be removed, and for every ton of metal add 1 cwt. of scrap iron; this should be spread evenly over the surface of the melted mass, then the furnace door is to be closed, and the whole brought to a state of fusion; the door is then opened, and the mass well and rapidly mixed, and immediately run off into sand moulds. As soon as the mass is sufficiently set, it is to be put in pits containing water enough to cover the mass; in a short time the mass falls to powder, the surplus water is run off, and the powder heaped up still moist, and allowed to remain for 24 hours. It must then be washed with water—and for this purpose the patentee makes use of a large wooden box, having a double pierced bottom, between which is placed wire gauze, from 25 to 35 meshes to the inch; this box is placed over what is called (by copper smelters) a tap-water pit, a vent is placed below the bottom of the box, and over the aperture of this vent, a wire gauze is fixed, of from 60 to 70 meshes to the inch; this vent is kept closed till the box is full of water—the water is then let off by opening the vent. This is to be repeated. It is then removed to the ordinary calcining furnace, and heat applied; very moderate at first, but gradually increased for 20 hours, till it is of a bright yellow heat; this heat is to be kept up for six hours longer, care being taken that the heat never rises sufficiently high to cake or fuse the powder; the powder is then withdrawn, and water sprinkled on it—then removed to the melting furnace, and to every ton of powder, 112 lbs. of anthracite coal, also in powder, and 10 lbs. of sand, are added; and, if the sample should be very infusible, a small quantity of slaked lime or fluor-spar must be added

as a flux. When melted, the slag is to be removed, and more of the mass added, repeating the process till the furnace is full. The furnace is then tapped, and run into sand or water. It is generally the case that the metal is found fit for the refining furnace; but should there be any regulus, this, as it is rich in copper, is to be roasted and melted. The slag obtained in this part of the process is re-melted with the ore in the ore furnace, and acts as a flux.

The claim is for the application of iron, and an alkali in smelting the ores of copper, and water for the purpose of disintegrating and decomposing the mass formed by such application. Min Jour.

Specification of Patent granted to Mr. Thomas Payne, *of Wandsworth, near Birmingham, for Improvements in the manufacture of Rolls, for Rolling Iron and other Metals. Patent dated August* 4, 1846. *Enrolled February* 4, 1847.

This invention relates to improvements in the mode of rolling iron and other metals. In constructing rolls for such purposes, it has heretofore been used to cast rolls with necks, or axles at their ends, such necks or axles being liable to be broken when in use; and it has also been attempted to cast rolls on to bars of iron, such rolls of iron being intended to strengthen the axles or necks of the rolls; but in all such cases the inventor states that bars of iron so used are much injured, being weakened, and unfit for such purposes; but in order that the important peculiarities of his invention may be more fully understood, he has given (which he believes to be) the present mode of manufacturing the rolls aforesaid, that is to say—in carrying his invention into effect, the inventor states, that in casting rollers, of any given size required, it will be necessary to leave the interior of any such roller hollow, so as to admit of the shaft or axis being passed through, and fixed therein by keys or otherwise; care being taken in casting, that the hollow space within a roller is cast or formed truly, so that the shaft when introduced shall fit accurately, allowing spaces for driving in wedges or keys at the end of the roll, which keys should be securely retained from moving by shrinking wrought iron collars on the shaft or axles; the working journals are turned in the wrought iron shafts, after keying on the rolls, and the surfaces of the rolls turned; by which means of manufacturing rolls for rolling iron and other metals the inventor is enabled to obtain them with stronger necks or axles. The wrought iron shafts or axles are passed through hollow rolls, which the inventor prefers to be cylindrical openings in the cast iron rollers, but the inventor does not confine himself thereunto, as other shapes may be used; but he claims the manufacture of hollow cast rolls for rolling iron and other metals, and fixing thereunto wrought iron shafts or axles, as hereinbefore described. Ibid.

Specification of a Patent granted to ETIENNE ABRAM MACCAUD, ***of Paris, for improvements in lamps and gas-burners.***—Sealed 22nd October, 1846.

This invention consists in surrounding the lower part of Argand burners with a casing, having numerous minute apertures in it, or made of any suitable open tissue, through which all the air to support combustion, both that which passes upwards through the centre of the flame and that which acts upon its exterior, is compelled to pass. By this arrangement no jets or partial currents of air can affect the flame, as the air is drawn, by the action of the flame, in minute streams from all parts of the circumference of the casing; and in its passage through the casing the temperature of the air is raised, so that the casing becomes a reservoir of hot air; and as the combustion is supported by the air from the reservoir only, a steady white flame is obtained.

Fig. 1 is a vertical section of an Argand gas-burner, with this invention applied thereto; and fig. 2 is a plan view of the same. *a*, is the burner; *b*, is a casing of wire-gauze, of one thousand meshes to the square inch, connected at the upper end to the chimney-gallery *c*, and having affixed to the lower end a ring, which rests in a cup *d*, attached to the stem of the burner; *e*, is an annular passage, made in the plate of the gallery *c* (which forms the top of the air chamber), for the purpose of admitting air into the space between the chimney and exterior of the flame. The chimney is fitted accurately into the gallery, so that no air can pass between its lower edge and the plate on which it rests; and the ring at the bottom of the casing *b*, is kept in close contact with the cup *d*, so as to prevent the passage of air at that part. Instead of the chimney-gallery consisting of a solid plate, with an annular opening in it, an annular piece of wire-gauze may be fixed over the space between the exterior of the burner and the casing.

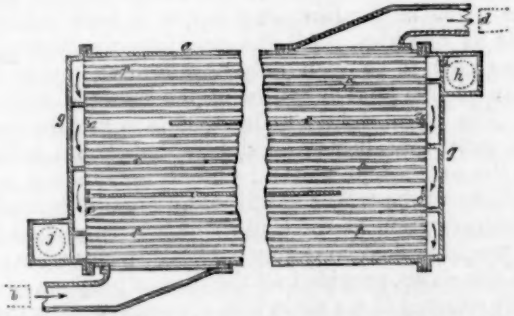
The patentee states, in conclusion, that he claims the application to lamps and gas-burners, of the kind called Argand (that is, burners having a channel for the passage of the air to the interior of the flame), of a hot-air chamber or reservoir, composed of wire-gauze, or of other tissues or materials, adapted to allow the passage of air to the flame in a minutely subdivided or diffused state; through which chamber the air is compelled to pass before it can act upon either the interior or exterior surfaces of the flame;—the improvements consisting, First, —in enclosing the whole of the space between the outer rim of the gallery or glass carriage and the bottom of the forked stem of the burner, so as to form but one chamber or reservoir for the supply of air to the burner; and, Secondly,—in admitting the air through wire-gauze, or otherwise, in such a subdivided or finely-diffused state into the said chamber, as to prevent any air, in the form of a jet, acting upon the flame.—[*Inrolled* 1847.]

Lon. Jour. Arts & Sci.

Specification of Patent granted to THOMAS HOWARD, *of the King and Queen Iron Works, Rotherhithe, in the county of Surrey, for improvements in Steam-engine Condensers.*—Sealed 25th March, 1846.

This invention relates to such condensing steam-engines as have their boilers supplied with water of condensation, and in which the steam is condensed by injecting such water, properly cooled down, into the condenser; the improvements consist in suitably arranging apparatus for cooling the water, previous to its injection into the condenser.

A longitudinal section of the apparatus employed by the patentee is shown in the annexed figure. *a*, is a tank, placed in any convenient situation, and supplied with cold water by pumps or other means; the water entering at *b*, is guided in its course through the tank by the plates *c*, and escapes at *d*. The ends of the tank are closed by brass plates *e*, in which are fixed the extremities of the tubes *f*, made of copper or other metal; and over the plates *e*, and open ends of the tubes *f*, are fixed "bonnets" *g*, divided into compartments, in the manner shown. On one bonnet there is a nozzle *h*, connected by a pipe with the hot-water cistern, and having a perforated plate *i*, fixed in it; and on the other bonnet there is a nozzle *j*, connected with the injection cock.



A quantity of water having been introduced into the hot-water cistern (by first starting the engine with the ordinary injection, or otherwise), sufficient to fill the tubes and properly effect the circulation, the injection-cock connected with the nozzle *j*, is opened, when the warm water will be caused, by the pressure of the atmosphere, to pass from the hot-water cistern, through the nozzle *h*, and to and fro along each series of tubes, determined by the divisions in each bonnet, as indicated by the arrows; by which means it will be reduced to nearly the same temperature as the water that surrounds the tubes; and, after passing through the nozzle *j*, into the condenser, the water will be discharged by the air pump into the hot-water cistern, from whence it will again pass into the tubes; any waste which occurs is made good by the ordinary injection.

The injection water and the refrigerating water may be made to change places, the former passing outside and the latter inside the tubes. The patentee recommends that the refrigerating surface be about ten feet per nominal horse power, when the steam is so employed as to leave the cylinder of the engine at ten pounds pressure per square inch, irrespective of the atmospheric pressure. He also recommends that the supply of cold water be not less than twice the quantity of the injection water.

In conclusion, the patentee says that patents were granted to him on October 13th, 1825, and November 31st, 1832*, in both of which a process of condensation by the reinjection of the same water or other liquid was included; he does not, therefore, claim such process; but he claims the so arranging apparatus that the water for condensation shall be subdivided into many streams in its progress to be cooled and used as injecting water, as described.—*Inrolled September*, 1846.

Ibid.

Extract from a Treatise on the Principles relating to the Specifications of a Patent for Inventions. By Wm. Spence, London.

Specifying Claims for Patents.—We come now to that part of the specification which, in a sense, may be said to be the most important of all: the part referred to is the claim. It is here that the essence, principle, or spirit of the invention is stated in the most distinct terms. The whole of the foregoing matter is here summed up and resolved into its one idea. All the previous description of circumstance comes now to be seen only as affording a clue to the right interpretation of this final definition of the essential character of the invention. The claim rightly understood is in fact the specification; but then in order that it may be rightly understood reference must be had to the antecedent matter: and it may indeed be said that the intelligibility of the whole specification greatly depends upon the particular interpretation of the claim which is suggested by such reference. It would be comparatively easy to discover what construction to put upon the claim, provided all the former portions of the specification plainly referred to the main idea contemplated by the invention, but such construction becomes a difficult matter when inconsistencies are found to exist on a comparison of some statements with others. So far as difficulties of this kind can be overcome, they are sometimes obviated by stating the claim first in a negative form. It is well to calculate upon every objection being raised to the specification that human ingenuity can devise: and accordingly it may be foreseen that the true, distinct nature of the invention is left open to misconstruction by a mere statement of what it is, since it may appear to be not only that, but something more also, (probably of a prejudicial character,) unless guarded from such construction by a suitable negation. This course is particular advisable when the patent is for a new combination of materials or processes, which in their separate form are old or not

*For description of these improvements see London Journal of Arts, Vol. XIV, First Series, p. 181 ,and Vol. XIII, Conjoined Series, p. 385.

open to be claimed. Crane's patent is a case in point. It is described as consisting in "the application of anthracite or stone-coal, combined with a hot-air blast in the smelting or manufacture of iron from iron-stone, mine, or ore." Now the patentee, in this case, feeling that the ground to be occupied by his invention is narrow, proceeds in his specification very carefully to lay such a foundation as will lead to a right apprehension of his real subject-matter. He shows, that is, the importance in a commercial point of view of using the stone-coal in the manufacture of iron: and thence infers that the abandonment of the article after use (which he cites as a known fact) was owing to some imperfection in the means employed to adapt it to the purpose. He accordingly gives instructions as to a practical mode of applying it to this use, the essential feature in which is the adaptation thereto, and combination therewith, of the hot-air blast. And after describing the mode by which he had actually accomplished his purpose, he says:—"I would have it understood that I do not claim the using of a hot-air blast separately in the smelting and manufacture of iron, as of my invention, when uncombined with the application of anthracite, or stone coal, and culm: nor do I claim the application of anthracite, or stone-coal in the manufacture or smelting of iron, when uncombined with the using of hot-air blast. But what I do claim as my invention is the application of anthracite, or stone-coal, and culm, combined with the using of hot-air blast in the smelting and manufacture of iron from iron-stone, mine or ore, as above described."

The claim being in this form anticipates any objection that might be raised on the ground of interference with the hot-air blast patent of Neilson, except that Crane must take a license from him to use that part of the combination. It also avoids the objection of including what was known to be old in the manufacture of iron, so far as a series of (it would appear unsuccessful) efforts to make stone-coal available for the purpose could render it so. But it likewise sets at rest all uncertainty as to the real subject-matter of the patent by the positive form in which the claim is stated. So that the whole effect of the claim may be stated as follows:—"Although the patent is not for the use of hot-air by itself (that is Neilson's), nor for the application of anthracite or stone-coal without the use of hot-air blast (that has been tried and has failed), yet it is for the application of anthracite or stone-coal combined with the use of hot-air blast for the manufacture of iron." And the only question that arises on the claim so stated is whether the subject-matter of a patent can stand upon such narrow ground. To this question the Court of Common Pleas answered in the affirmative—such opinion, in this case, resting upon the fact that the balance of the evidence at the trial showed a substantive effect to have resulted from the combination, viz., an improved quality of iron at a diminished cost of production. It would seem that before the date of this patent the application of anthracite or stone-coal to the manufacture of iron was felt to be a desideratum, but one which was not attained: the patentee, however, succeeded in producing better iron at a cheaper rate by the use of this article. To what cause then is his success attributable? The essential difference between his mode of operation and that practised by his predecessors was, that whereas

they used stone-coal uncombined with a hot-air blast, he used it in combination therewith, and this being the only essential distinction between the two modes, to such is ascribed the difference of result.

Civ. Eng. & Arch. Jour.

FRANKLIN INSTITUTE.

Monthly Meeting, July 15, 1847.

Mr. Reid, Superintendent of the Magnetic Telegraph Company, exhibited and explained the operation of an ingeniously contrived machine invented by him for preventing the action of atmospheric electricity during thunder storms, from injuriously affecting the apparatus used in telegraphic communications. Mr. R. said that the efficiency of this contrivance was fully tested during the thunder storm of Tuesday evening last, when the interruption caused by the heaviest discharges of atmospheric electricity produced only a momentary derangement of the writing apparatus, but not of a nature seriously to interrupt the continuity of the telegraphic communication. The line to which his instrument was attached was enabled by it to remain in operation during the storm, while in all the others it became necessary to detach the wires in order to prevent injury to the magnets.

At the request of the Institute, Mr. Reid promised, for the Journal, a full description of this interesting and useful invention.

Mr. Coggins described the mode of manufacturing a material for fuel in locomotive engines at Reading in Pennsylvania. This article is composed of fine or pulverized anthracite coal, cemented into a mass by bitumen previously reduced to a fluid state by heat. When these ingredients have been well mixed, the mass is pressed in moulds of a convenient shape and size, retaining, afterwards, a sufficient degree of solidity. The combustion of this fuel he described as being very lively, and resembling that produced from pine knots, giving forth much flame and being, apparently, well adapted for locomotives. The cost of this prepared fuel was not stated.

Mr. G. W. Smith read a letter from Caleb Newbold, jr., President of the Chesapeake and Delaware Canal Co., accompanied by a 4 inch iron spike which had been tinned to prevent oxidation. This spike, Mr. N. says, was inserted between two stones in the wall of the Ches. and Del. Canal, beneath the surface of the water, in which situation it remained during 18 months. At the end of this period the spike was taken up, and was found to be much corroded, the coating of tin having almost entirely disappeared. The laminæ of the iron were distinctly visible, owing to the unequal degree of oxidation resulting from their different qualities; the surface of the spike having lost its original smoothness, and presenting a series of small grooves or striæ, in a longitudinal direction on the body of the spike, and on its head, radiating from the centre. The corrosion was greatest on that part of the spike which projected into the water;—about half its length, which had been inserted between the stones of the wall, being less corroded than the projecting portion.

Mr. Towne read a letter from Capt. Robinson of the U. S. Steamer W. L. Marcy, relative to incrustations formed in the boilers of that vessel on her voyage from Philadelphia to Brazos St. Iago. Specimens of the incrustation *(sulphate of lime)* were exhibited, which were about an eighth of an inch in thickness, having a fibrous crystalline structure, the fibres running in a direction perpendicular to the surface of the boiler. The color of the cross fracture is a glistening pearly white.

Capt. Robinson says, "The entire inside surface of the boiler was thickly encrusted with this substance, which is said to accumulate while the vessel is near the Bahama banks. Its adherence to the inner surface of the boiler was so great that the usual methods of cleaning were found to fail, and it became necessary to have recourse to scrapers of a peculiar construction, made for the occasion. The steamer Marcy was on the banks only about sixteen hours, during which time this substance was deposited on the boilers. The boilers were blown off every thirty minutes during the entire passage."

He further observes, "An English engineer at Key West, who has been long employed in the British government steamers on the West India station, informed me that he had found great difficulty in keeping his boilers from burning, and, in consequence, was careful to keep as far from these banks as possible; but found that by introducing a small portion of ammonia into his boilers, it effectually prevented all substances of any description from forming—keeping them, at all times, perfectly clean."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Production of Light by Heat. By JOHN WILLIAM DRAPER, *M. D., Professor of Chemistry in the University of New York.*

Continued from Page 128.

I proceed now to the third branch of the inquiry,—to examine the relation between the temperatures of self-luminous bodies and the intensity of the light they emit, premising it with the following considerations.

The close analogy which is traced between the phenomena of light and radiant heat lends countenance to the supposition, that the law which regulates the escape of caloric from a body will also determine its rate of emission of light. Sir Isaac Newton supposed that whilst the temperature of a body rose in arithmetical progression, the amount of heat escaping from it increased in a geometrical progression. The fallacy of this was subsequently shown, by Martin, Erxleben, and Delaroche; and finally Dulong and Petit gave the true law, "When a body cools *in vacuo*, surrounded by a medium whose temperature is constant, the velocity of cooling for excess of temperature in arithmetical progression increases as the terms of a geometrical progression, diminished by a constant quantity." The introduction

of this constant depends on the operation of the theory of exchanges of heat; for a body, when cooling under the circumstances here given, is simultaneously receiving back a constant amount of heat from the medium of constant temperature.

Whilst Newton's law represents the rate of cooling of bodies, and therefore the quantities of heat they emit, when the range of temperature is limited, and the law of Dulong and Petit holds to a wider extent, there are in our inquiry certain circumstances to be taken into account not contemplated by those philosophers. Dulong and Petit throughout their memoir regard radiant heat as a homogeneous agent, and look upon the theory of exchanges, which is indeed their starting-point and guide, as a very simple affair. But the progress of this department of knowledge since their times has shown, that precisely the same modifications as are found in the colors of light, occur also for heat; a fact conveniently designated by the phrase, "ideal coloration of heat;" and further, that the color of the heat emitted depends upon the temperature of the radiating source. It is one thing to investigate the phenomena of the exchanges of heat-rays of the same color, and another when the colors are different. A perfect theory of the exchanges of heat must include the principle of ideal coloration, and, of course, so too must a law of cooling applicable to any temperature.

There is another fact to some extent considered by Dulong and Petit, but not of such weight in their investigations, where the range of temperature was small, as in ours, where it rises as high as nearly 3000° F.; I mean the difference of specific heat of the same body at different temperatures. At the high temperatures considered in this memoir, there cannot be a doubt that the capacity of platinum for heat is far greater than that at a low point. This therefore must control its rate of calorific emission, and probably that for light also.

From these and similar considerations, we should be prepared to discover that as the temperature of an incandescent solid rises, the intensity of the light emitted increases very rapidly.

I pass now to the experimental proofs which substantiate the foregoing reasoning.

The apparatus employed as the source of the light and measure of the temperature was the same as in the preceding experiments,—a strip of platinum, brought to a known temperature by the passage of a voltaic current of the proper force, and connected with an index which measured its expansion.

The principle upon which I have determined the intensities of the light is that first described by Bouguer, and recently introduced by M. Masson. After many experiments I have been led to conclude that this is the most accurate method known.

Any one who will endeavor to determine the intensities of lights by Rumford's method of contrasting shadows, or by that of equally illuminated surfaces, will find, when every precaution has been used, that the results of repeated experiments do not accord. There is moreover the great defect, that where the lights differ in color it is

impossible to obtain reliable measures, except by resorting to such contrivances as that described by me.*

Bouguer's principle is far more exact; and where the lights differ in color, that difference actually tends to make the result more perfect. As it is not generally known, I will indicate the nature of it briefly.

Let there be placed at a certain distance from a screen of white paper, a candle so arranged as to throw the shadow of a ruler, or other opaque body, on the screen. If a second candle be placed also in front of the paper and nearer than the former, there is a certain distance at which its light completely obliterates all traces of the shadow. This distance is readily found; for the disappearance of the shadow can be determined with considerable exactness. When the lights are equal, Bouguer found that the relative distances were as 1 : 8; he inferred therefore, correctly, that in the case of his eye, the effect of a given light was imperceptible when it was in presence of another sixty-four times as intense. The precise number differs according to the sensibility of different eyes, but for the same organ it is constant.

Upon a paper screen I threw the shadow of a piece of copper, which intercepted the rays of the incandescent platinum: then taking an Argand lamp, surrounded by a cylindrical metal shade through an aperture in which the light passed, and the flame of which I had found by previous trial would continue for an hour almost of the same intensity, I approached it to the paper until the shadow cast by the copper disappeared. The distance at which this took place was then measured, and the temperature of the platinum determined.

The temperature of the platinum was now raised; the shadow became more intense, and it was necessary to bring the Argand lamp nearer before it was effaced. When this took place the distance of the lamp was again measured, and the temperature of the platinum again determined.

Table of the Intensity of Light emitted by Platinum at different Temperatures.

Temperature of the platinum.	Distance of Argand Lam		Mean.	Intensity of Light.
	Experiment 1.	Experiment 2.		
°				
980	.....	.....	.....	0·00
1900	54·00	54·00	54·00	0·34
2015	39·00	41·00	40·00	0·62
2130	24·00	24·00	24·00	1·73
2245	18·00	19·00	18·50	2·92
2360	14·50	15·50	15·00	4·40
2475	11·50	12·00	11·75	7·24
2590	9·00	9·00	9·00	12·34

In this manner I obtained several series of results, one of which is

* Phil. Mag., August, 1844.

given in the foregoing table. They exhibited a more perfect accordance among each other than I had anticipated. The intensity of the light of the platinum is of course inversely proportional to the square of the distance of the Argand lamp at the moment of the obliteration of the shadow.

In this table the first column gives the temperatures under examination in Fahrenheit degrees: the second and third, the distances of the Argand lamp from the screen, in English inches, in two different sets of experiments; the fourth, the mean of the two; and the fifth, the corresponding intensity of the light.

From this it is at once perceived, that the increases in the intensity of the light, though slow at first, become very rapid as the temperature rises. *At* 2590° *the brilliancy is more than thirty-six times as great as it is at* 1900°.

Thus, therefore, the theoretical anticipation which we founded on the analogy of light and heat is completely verified; and we discover that as the temperature of a self-luminous solid rises, it emits light in a greater proportion than would correspond to the mere difference of temperature. To place that analogy in a still more striking point of view, I will here introduce some experiments I have made in relation to radiant heat. No Chemist, so far as I am aware, has hitherto published results for high temperatures, or endeavored to establish, through an extensive scale, the principle of Delaroche, that "the quantity of heat which a hot body gives off in a given time by way of radiation to a cold body, situated at a distance, increases, other things being equal, in a progression more rapid than the excess of the temperature of the first above that of the second."

As my object on the present occasion is chiefly to illustrate the remarkable analogy between light and heat, the experiments now to be related were arranged so as to resemble the foregoing; that is to say, as in determining the intensities of light emitted by a shining body at different temperatures, I had received the rays upon a screen placed at an invariable distance, and then determined their value by photometric methods; so, in this case, I received the rays of heat upon a screen placed at an invariable distance, and determined their intensity by thermometric methods. In this instance the screen employed was in fact the blackened surface of the thermo-electric pile. It was placed at a distance of about one inch from the slip of incandescent platinum, a distance sufficient to keep it from any disturbance from the stream of hot air arising from the metal: care also was taken that the multiplier itself was placed so far from the rest of the apparatus, that its astatic needles could not be affected by the voltaic current igniting the platinum or the electro-magnetic action of the wires used to modify the degrees of heat.

The experiments were conducted as follows:—the needles of the thermo-multiplier standing at the zero of their scale, the voltaic current was passed through the platinum, which immediately rose to the corresponding temperature, and radiated its heat to the face of the pile. The instant the current passed, the needles of the multiplier moved, and kept steadily advancing upon the scale. At the close of

one minute, the deviation of the needle and the temperature of the platinum were simultaneously noted, and then the voltaic current was stopped.

Sufficient time was now given for the needle of the multiplier to come back to zero. This time varied in the different cases, according to the intensity of the heat to which the pile had been exposed: in no instance, however, did it exceed six minutes, and in most cases was much less. A little consideration will show that the usual artifice employed to drive the needles back to zero, by warming the opposite face of the pile, was not admissible in these experiments.

The needles having regained their zero, the platinum was brought again to a given temperature, and the experiment conducted as before. The following table exhibits a series of these results.

Table of the Intensity of Radiant Heat emitted by Platinum at different Temperatures.

Temperature of the Platinum.	Intensity of heat emitted.		Mean.
	Experiment 1.	Experiment 2.	
°			
980	·75	1 00	·87
1095	1·00	1·20	1·10
1210	1·40	1·60	1·50
1325	1·60	2·00	1·80
1440	2·20	2 20	2·20
1555	2·75	2·85	2·80
1670	3·65	3·75	3·70
1785	5·00	5·00	5·00
1900	6·70	6·90	6·80
2015	8·60	8·60	8·60
2130	10·00	10·00	10·00
2245	12·50	12·50	12·50
2360	15 50	15·50	15·50

In this table the first column gives the temperatures of the platinum in Fahrenheit degrees; the second and third, two sets of experiments, expressing the arc passed over by the needle at the close of a radiation lasting for one minute, each number being the mean of several successive trials; and the fourth, the mean of the two. It therefore gives the radiant effect of the incandescent platinum upon the thermo-multiplier for the different temperatures.

Of course it is understood that I here take the angular deviations of the needle as expressing the force of the thermo-electric current, or, in other words, as being proportional to the temperatures. This hypothesis, it is known, is admissible.

It therefore appears that the quantity of heat radiated by incandescent platinum, at 980° being taken as unity, it will have increased at 1440° to 2·5; at 1900° to 7·8; and at 2360° to 17·8, nearly: the rate of

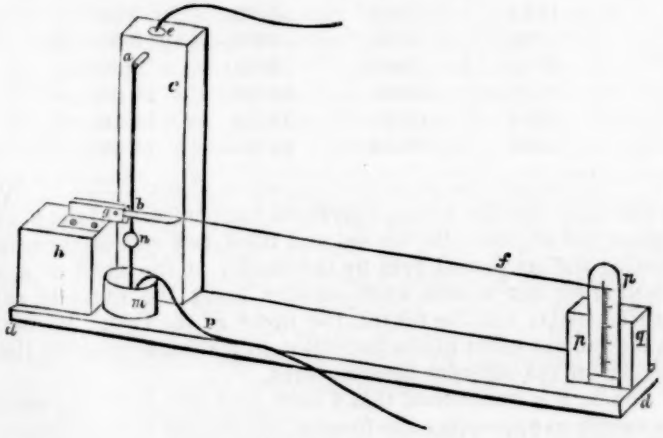
increase is therefore very rapid. Further, it may be remarked, as illustrative of the same fact, that the increased quantity of heat radiated by a mass of platinum in passing from 1000° to 1300°, is nearly equal to the amount it gives out in passing from common temperatures up to 1000°.

I cannot here express myself with too much emphasis on the remarkable analogy between light and heat which these experiments reveal. The march of the phenomena in all their leading points is the same in both cases. The rapid increase of effect as the temperature rises is common to both.

It is not to be forgotten, however, that in the case of light we necessarily measure its effects by an apparatus which possesses special peculiarities. The eye is insensible to rays which are not comprehended within certain limits of refrangibility. In these experiments, it is requisite to raise the temperature of the platinum almost to 1000° before we can discover the first traces of light. Measures obtained under such circumstances are dependent on the physiological action of the visual organ itself, and hence their analogy with those obtained by the thermometer becomes more striking, because we should scarcely have anticipated that it could be so complete.

Description of the apparatus employed in the foregoing experiments.

The source of light is in all instances a slip of platinum foil 1·35 inch long, and $\frac{1}{20}$th of an inch broad, ignited by the passage of a voltaic current, and placed in such a position that its dilatation could be measured by the movements of an index over a graduated scale.



In the figure, *a b* represents the slip of platinum, the upper end of which is soldered to a stout and short copper pin *a*, firmly sunk in a block of wood *c*, which is immovably fastened on the basis *d d* of the instrument. A cavity *e*, half an inch in diameter, is sunk in the block *c*,

and into this cavity the pin *a* projects; so that when the cavity is filled with mercury, a voltaic current may be passed through the pin and down the platinum.

The other extremity of the platinum *b* is fastened to a delicate lever *b f*, which plays on an axis at *g*, the axis working in brass holes supported on a block *h*. Immediately beneath the platinum strip, and in metallic communication with it, a straight copper wire dips down into the mercury cup *m*; on this wire there is a metal ball *n*, weighing about 100 grains. The further end of the index plays over a graduated ivory scale *p p*, which is supported on a block *g*, and can be moved a little up and down, so as to bring its zero to coincide with the index at common temperatures.

The action of the instrument is readily understood. In the mercury cup *e* dip one of the wires N of a Grove's battery of three or four pairs, the other wire P being dipped into the cup *m*. The current passes through the platinum, which immediately expands, the weight *n* lightly stretching it. The index *f* moves promptly over the scale, indicating the amount of expansion, and therefore the degree of heat. Remove the wire N out of its mercury cup *e*, the platinum instantly becomes cold, and pulls the lever to the zero point.

When the platinum is thin, so as to be quite flexible at the point *b*, where it is fastened to the index, the movements take place with such promptitude and precision as to leave nothing to be desired. When the heat has been very high and long continued, the limit of elasticity of the platinum is somewhat overpassed, and it suffers a slight permanent extension. But as the ivory scale *p p* can slide up and down a little, the index is readily re-adjusted to the zero point.

The temperature of the platinum depends entirely on the force of the current passed through it. By intervening coils of brass wire of lengths adjusted beforehand, so as to resist the current to a given extent, any desired temperature may be reached. I found it convenient to intervene in the course of the current one of Prof. Wheatstone's rheostats, so as to be able to bring the index with precision to any degree, notwithstanding slight changes in the force of the voltaic battery.

The following are the dimensions and measures of the instrument I have used:—Length of the platinum strip, 1·35 inch; length of the part actually ignited, 1·14 inch; width of ditto, $\frac{1}{20}$th of an inch; length of the index from its centre of motion to the scale, 7·19 inches; distance of the centre of motion of index from the insertion of the platinum at the point *b*, ·22 inch; multiplying effect of the index, 32·68 times; length of each division on the ivory scale, ·021 inch. From this it would appear, by a simple calculation, using the coefficient of dilatation of platinum given by Dulong and Petit, that each of the divisions here used is equal to 114·5 Fahrenheit degrees. For the sake of perspicuity I have generally taken them at 115°.

The Grove's battery I have employed has platinum plates three inches long and three quarters wide; the zinc cylinders are two inches and a half in diameter, three high, and one-third thick. As used in these experiments, it could maintain a current nearly uniform for an hour. I commonly employed four pairs.

On the Gauges at present used, for measuring the thicknesses of sheet metals and wires, and proposals for a new system of Gauges, founded on the decimal subdivision of the Standard Inch. By Mr. Holtzapffel.

(Continued from page 310.)

The remedy proposed to remove the arbitrary incongruous system of gauges now used, is simply and in every one of the cases referred to, and also in all others requiring minute measures, to employ the decimal divisions of the inch, and those under their true appellation.

Thus for most purposes the division of the inch into one hundred parts would be sufficiently minute, and the measures 1. 2. 5. 10. 15. or 100 hundredths, would be also sufficiently impressive to the mind; their quantities might be written down as 1. 2. 5. 10. 15 or 100 hundredths, as the decimal mode of expression might, if preferred, be safely abandoned, and the method would be abundantly distinct for common use if the word "Hundredths" were stamped upon the gauge, to show that numerals denoted hundredths of the inch, quantities which could be easily verified by all.

It does not follow that the entire hundred notches should be at all times used, as in many cases it might suffice that below 20 hundredths, every size should be employed:—from 20 to 50 hundredths, every alternate size, from 50 to 100 hundredths every fifth size. As at present also, the upper or lower part of the series of terms might be omitted to any desired extent, in those cases where they were beyond the particular wants of the artizan or the particular branch of trade, in order to lessen the bulk and expense of the gauge.

It may be objected to this scheme, that for the more valuable metals, and the more minute purposes, the quantity of the one hundredth of an inch is too coarse a difference. Two facile modes of remedy may be here applied. The first to make half sizes; thus 8½ or 8·5 would of course denote the medial interval between 8 and 9 hundredths. Or secondly, and preferably, below one-tenth of an inch, a finer scale might be substituted for the more minute and delicate purposes, namely, a gauge based in precisely the same manner, on the *thousandth* of the inch as the unit, which would give a much finer degree of subdivision than is afforded by any of the arbitrary gauges in general use; in this case the intervals being derived from the thousandth of an inch, the word "Thousandths" should be stamped on every such gauge.

In practice no difficulty could be seriously felt even without this precaution of marking the gauges respectively with the word hundredths or thousandths; as we should not more readily mistake 5 thousandths for 5 hundredths, than we should 5 tenths or half an inch, for 5 whole inches, or 5 entire inches for as many feet.

Neither is it to be admitted that no such gauges are attainable as may be read off in hundredths or thousandths. The demand would immediately create the supply, and there could be no more difficulty

in constructing the gauges of the customary forms, with notches made to systematic and *defined* measures that may be easily arrived at or tested, than with their present unsystematic and *arbitrary* measures, which do not admit of verification.

Besides, for those who desire to possess them, several very correct decimal gauges already exist, amongst which may be cited the decimal sector gauges long since recommended, and published by the Society of Arts, Edinburgh, and various sliding gauges with verniers, some to read off in hundredths, and finer ones in thousandths, of the inch, all of which have been long and constantly used in the author's manufactory.

To these may be added, La Rivière's gauge, modified and enlarged from that used for the balance springs of watches amongst the Geneva watchmakers—Chater and Haywood's gauge for sheet metals and glass—Walker's gauge for sheet iron—Whitworth's micrometer gauge, and others, which may be severally read off to the thousandth of the inch, and even more minute quantities, and amongst which kinds sufficient choice exists for almost every purpose.

The advantages offered by this proposed application of decimal measures, appear to be numerous and considerable, the more especially in those cases of small measures, where the ordinary wire gauges on the one hand, and the coarse division of ordinary foot rules on the other, are obviously insufficient for accurate purposes. Amongst these advantages may be enumerated the following:—

The proposed decimal scheme would introduce one universality of system, intelligible alike to all, instead of the numerous and irregular measures now used, which are but partially and indifferently known and lead to frequent mistakes.

It would give a superior idea of particular magnitude, and enable the theoretical and practical man to proceed with so much more decision in their respective communications.

In conveying verbal or written instructions, the system would be in every way superior to the usual methods, as being almost free from the chance of misunderstanding; more especially as some of the decimal sliding gauges are so small as hardly to take up more room in the pocket than an ordinary penknife, and might be therefore continually within reach for reference.

When certain objects are required to be so proportioned as to constitute a series; the intervals between the decimal measures would be far more easily arranged and appreciated, than those of vulgar fractions; and if calculation were referred to, the decimal figures, especially when divested of the decimal point, and the zeros to the right of the same, would be immediately intelligible to the least informed, from being then no more in fact than simple numerals.

Quantities expressed decimally would be more easily written down and more exactly defined, than the compound fractions, such as $\frac{3}{8}$ and $\frac{1}{16}$ of an inch—or than the still more obscure method, of $\frac{3}{8}$ of an inch *full* or *bare* as the case might be, which latter nearly sets all attempt at exactness at defiance.

The smaller aliquot fractions of the inch, such as the $\frac{1}{10}$, $\frac{1}{12}$, $\frac{1}{14}$, $\frac{1}{16}$, $\frac{1}{18}$, $\frac{1}{20}$, &c., of an inch, although in themselves very precise, do not from their nature, so readily admit of definition or comparison, as the quantities 2, 3, 4, 5, 6, 7, 8, 9, or 10 hundredths of an inch; because, in the vulgar fractions every one has a *specific* relation to the inch, whereas the decimal terms have one *general* relation, decimals being sometimes considered as the numerators of fractions, all having the constant denominator, unity, or 100, 1000, &c.; and therefore the latter, or the decimal terms, constitute a simple arithmetical series, or one in which the intervals are alike, but this is not the case with vulgar fractions.

It would bring all foreign measures within reach of our workshops. For example, in the United States of America and Russia, English measure is employed, and no difficulty would be felt in reference to those countries. And as most of the National Foot measures are more than 11 inches English, and less than 13, even if they are considered for the time as equal to our own foot, and without any adjustment being attempted, the average error would not exceed about five per cent. And further, when two of Holtzapffell and Co's engine-divided scales, the one of the particular foreign measure, and the other of English inches, are laid side by side, they show visually, as on a slide rule, the correspondence between any quantity of such foreign measure with our own, as more fully explained in the author's pamphlet "On a New System of Scales of Equal Parts," in which this and numerous other employments of scales of equal parts are treated at length.

The decimal scheme would allow the exact weight in every superficial foot of sheet metals and other substances to be readily arrived at. Thus, as a cubic foot of water weighs 1000 ounces troy, the specific gravities of lead, copper, silver, &c., denote at the same time how many troy ounces are severally contained in one cubic foot of the same. The specific gravity divided by 1200, gives the weight of a plate or film, the one hundredth of an inch thick, and thence a table may be readily computed, by addition alone, to show the weight of plates of any thickness in troy ounces.

These calculations would be correct at once for gold and silver, as these metals are estimated by troy weight; but for other substances requiring avoirdupois weight, the numbers expressing the specific gravities of the substances must be previously altered by one of the usual methods, namely, either by multiplying them by 192, and dividing the product by 175, numbers which represent the ratio between troy and avoirdupois ounces; or else instead thereof, the specific gravities of substances may be multiplied by the decimal constant usually employed for effecting the same end.

In this method, also, constant multipliers may be readily found, for thus determining, from the specific gravities of the several materials, the exact thickness of plates or sheets of the same, which shall precisely weigh one ounce or one pound, either troy or avoirdupois, as may be required. This has already been done by Mr. Hayward, as regards crown glass; for, assuming its specific gravity to be 2·52, when

the glass is of the thickness of ·1525, (or one-tenth and a half, nearly,) it weighs 32 avoirdupois ounces to the superficial foot, and thence, by Mr. Hayward's calculation, are obtained the following numbers,—the first line denotes the weight of crown glass in ounces, in every superficial foot, the second line the corresponding thickness in thousandths of the inch, ranging from about 5 to 152 thousandths:—

Crown glass of	1,	2,	4,	8,	12,	16,	20,	24,
Measures	·00476,	·0095,	·019,	·038,	·0571,	·0762,	·0952,	·1333,

28, 32 ounces.
·1429, ·1524 inch.

The above and the intermediate terms are sometimes engraved on Messrs. Chater & Haywood's gauges, alongside of the line of gradations which denotes thousandths; and at other times, instead of the weight per foot, are engraved divisions, indicative of the 8th, 9th, 10th, 11th, 12th, &c., of the inch; which quantities are of course obtained by simply dividing 1000 by those respective numbers.

Tables might, in the above manner, be very readily computed that would show the weights in every superficial foot of the metals and other materials for all defined thicknesses; and, also, other tables, for showing how thick the metals should be, in order to weigh exactly so many ounces to the superficial foot. These matters could be also arrived at, by the employment of scales of equal parts, laid down in the proportions of the specific gravities of the substances; and, in the opinion of the author, they could be worked out with even greater simplicity and universality, by a decimal proportional instrument he has some time since contrived, which is applicable to the visual development of all ratios that have reference to all decimal arithmetic, including those of interest, discount, profit, and other calculations to which the term per cent. is applied.

In conclusion, the author begs to add, that he does not suggest any alteration whatever, as regards those measures for which the division of the foot-rule, into eighths and sixteenths, may be found sufficiently precise and minute. But he would ask, whether, for more minute measurements, greater convenience and distinctiveness would not result, from the general employment of measures expressed in hundredths of the inch, than from the employment of the many gauges for specific uses, the sizes and numbers of which are entirely devoid of system, and which gauges may be considered as unknown beyond the particular trades in which they are employed.

How confusing would it be, if the measures by which broad cloths, linens, cottons, silks, velvets, carpets, and other textile fabrics, are manufactured and sold, were all different, instead of being uniformly the yard measure; and yet this incongruity fully applies to the various articles, whose measurements are described under the mystical names of Number, Size, Gauge, and other appellations, which assume different values in different branches of manufacturing art; as, for example, in the various kinds of sheet metals, various kinds of wires, in tubes, joiners' screws, and vast numbers of small manufactured articles, the various sizes of which are arbitrarily designated as Nos. 1, 2, 3, 4, &c.

Why not, in all these branches of trade, describe every thing mea-

suring $\frac{1}{10}$th of an inch, as No. 10; those of $\frac{3}{10}$ths of an inch, as No. 30? and then, in sets of objects required to be nearly alike, the succeeding numbers could be 31. 32. 33. 34. 35. 36. &c; or, if fewer and wider variations were wanted, the series might be 32. 34. 36. 38. 40.; or else 35. 40. 45. 50. 55. Every trade could select any portion of the series it might require, both as regards general magnitude, and the greater or less intervals between the sizes, and with the power of adding to, or subtracting from, the scale first selected, as circumstances might suggest.

But there should be one common understanding, that the commercial numbers or sizes, when different from the measures of the foot-rule, should always be understood to be hundredths of the inch, (in some rare instances thousandths,) as then, from the unity of system, no confusion or difficulty could possibly arise.

It may be true, that some of the proposals, having reference to the weights of materials in the superficial foot, the correspondence with foreign measures, and some of the projects principally intended for the purposes of science, may not be required in everyday practice; but still much remains in the system, that, in the opinion of the author, would admit of very easy introduction, and most general and satisfactory employment.

In respect to the practical application of the method of decimal divisions, as regards mechanical construction, the author can speak most satisfactorily, from some years' experience in his own manufactory, as he has found it to be most readily followed by his work-people, and also, that it has avoided frequent and vexatious misunderstandings, to which, before its adoption, he was frequently subjected, from the want of a more minute and specific system of measure, than is afforded by the common foot-rule and wire gauges.

Therefore, from conviction of the usefulness and practicability of the decimal system of measures for small quantities, he would most strongly urge its general, or, indeed, universal, adoption, as above proposed; the more especially, as it is a change that would be attended with very little temporary inconvenience or expense—circumstances which greatly retard all attempts at generalization.

Glasgow Prac. Mech. & Eng. Mag.

On Nitric Mannite. By M. Sobrero.

Translated for the Journal of the Franklin Institute.

Since the re-action of nitric acid upon organic substances has occupied the attention of chymists, a number of bodies have been discovered which are very interesting in a scientific point of view; but of these the arts have only for their share gun cotton, of which the ultimate fate is still very uncertain. While the question with regard to this cotton is being determined, I announce to the Academy that another substance, possessing fulminating properties in the highest degree, is furnished by the re-action of nitric acid upon *mannite*,—the nitric mannite of which Messrs. Flores Domonte and Menard have already given the composition.

The fulminating mannite has the property of exploding under the blow of a hammer, with the same violence as the fulminate of mercury; and produces, in its decomposition, the heat necessary for exploding gunpowder. As soon as I was acquainted with this property, I proceeded to its application, and myself prepared some capsules in which I placed a small portion of the nitric mannite, crystallized in alcohol. With these I primed a fowling piece, and discharged it, in the same manner as if ordinary percussion caps had been used. It is hoped that more extended experiments will be made in order to determine the most convenient mode of substituting this material for fulminating mercury; but, from the present, I think certain propositions regarding it may be considered as established:

1. That the fulminating mannite will be always cheaper than fulminating mercury.

2. That it is more easily prepared, and that in its manufacture the workmen are not exposed to the serious dangers to which those are liable who prepare the ordinary fulminating powders.

It should be cheaper than fulminating mercury, because the price of manna is moderate;—because the preparation of mannite furnishes as residuum the uncrystallizable material, mixed with a little mannite, which may be still employed in medicine and for veterinary purposes as a purgative;—and because, according to the analysis of Messrs. F. Domonte and Menard, mannite by its conversion into nitric mannite, has its weight very considerably increased (from 100 to 225.)

In its preparation and manipulation it is less dangerous:—indeed the preparation is only accompanied by the disengagement of some vapor of nitric acid. The fulminating mannite explodes only by a violent blow, between two hard bodies; heat gradually applied will cause it to melt, and afterwards decompose it, but without explosion. It may, indeed, be placed upon a piece of paper, and touched with a burning coal, when it will melt without detonating. Or the paper upon which it is placed may be burned and the substance thus decomposed without exploding.

The fulminating mannite is decomposed beneath the stroke of a hammer without leaving a residuum, and, as it appears, without producing nitrous vapors. It seems to be completely resolved into carbonic acid, water, and azote. And, finally, it may be kept, for an indefinite length of time, without decomposition.

Comptes Rendus, July, 1847.

Observations upon Silica. *By* M. Doveri, of Florence.

Translated for the Journal of the Franklin Institute.

It appears, from the observations contained in the memoir submitted by this author:

1. That the alkaline silicates, decomposed by acids, and particularly by hydrochloric acid, deposit the greatest part of the silica which they contain when the acid is added drop by drop, in excess; while if

the same quantity of acid be added at once, not the smallest quantity of silica is precipitated.

2. That the silica, having been once precipitated, is not re-dissolvable in the acids, whatever may have been its origin, whether precipitated from an alkaline silicate by an acid, or from fluoride of silicium by means of water.

3. That the weaker acids, such as carbonic, sulphurous, boracic and the vegetable acids, decompose the alkaline silicates at ordinary temperatures, and precipitate the silica either in white powder or gelatinous flakes.

4. That the silica in a state of minute division, either anhydrous or hydrated, is capable of decomposing the alkaline carbonates in solution in water, at the boiling point, dissolving in the fluid.

5. That the silica precipitated at the ordinary temperature, from a solution of an alkaline silicate or the fluoride of silicium, is a hydrate of definite proportions, of which the composition may be expressed by the formula HO, Si O^3; that this hydrate, at the temperature of 100°, loses one equivalent of water, and is changed into another, composed HO, 2Si O^2.

6. That when a solution of an alkaline silicate is treated by a metallic solution, there results a precipitate consisting of a mixture of hydrated silica and metallic silicate:—that the metallic silicate is entirely dissolved by the mineral acids, while the free silica remains undissolved.

7. That a limpid solution, highly charged with silica in hydrochloric acid, may be obtained by dissolving in that acid the silicate of copper, and precipitating the copper by sulphuretted hydrogen.

8. That the solution of silica in hydrochloric acid, evaporated slowly under an air pump, yields hydrated silica (HO, Si O^2) perfectly crystallized in very slender and transparent acicular crystals, grouped together in stars or tufts. Ibid.

Experiments upon the Crystallization of Carbon. By M. Cagniard Latour.

Translated for the Journal of the Franklin Institute.

More than ten years ago, I presented some diamonds to several members of the Academy of Sciences, informing them at the time that these diamonds had been produced by means of a process invented by me, because I then believed it. As I now acknowledge that I was mistaken, I consider it a duty to declare it to the Academy.

The only somewhat remarkable substances that I obtained in my own experiments upon the crystallization of carbon, were microscopical laminæ or scales, of a circular form, very thin, transparent, and colorless, the largest of which were hardly the twenty-fifth part of a millimetre in diameter.

Their production being difficult, I have not yet been able to obtain a quantity sufficient to enable me to determine their composition; but it nevertheless seems allowable to consider them as having some ana-

logy with the diamond, inasmuch as in the divers experiments which, with the aid of the microscope, I have made upon these laminæ, and of which the number was about 160, the general results were as follows: 1. The hydrate of potassa in fusion has no action upon them at a temperature in which this alkali acts briskly upon silica. 2. They are sufficiently hard to scratch glass. 3. They entirely disappear when brought to a red heat in the open air.

These scales were produced in the two experiments of which I have given the details in a memoir which I have this day had the honor to submit to the Academy. Ibid.

The Difference which Exists between Gilding by Mercury and Electro-Gilding. By M. Barral.

The author of this paper says that he has been frequently called upon to solve the following question, viz.:—"By what means had a certain article of copper or silver been gilded?" This could not possibly be ascertained with certainty by mere inspection, even by the most experienced eye. M. Barral has, however, discovered a certain means of ascertaining the fact by chemical reaction. He has found that by attacking the articles to be tested with dilute nitric acid, either warm or cold, pellicles of gold are obtained, of the exact form of the article; provided the acid be not allowed to act too energetically. These pellicles are of a yellow gold color on both sides, when obtained from articles gilt by simple immersion in an alkaline solution of gold, or by means of the galvanic current decomposing certain solutions. On the contrary, the pellicles produced on the surfaces of articles gilt by mercury are of a reddish-brown color on the side next the surface of the articles gilt.

In order to explain this difference in the appearance of the pellicles of gold, M. Barral first had certain articles gilt by the mercury process with certain quantities of gold. The articles thus gilt, on being acted upon by dilute nitric acid, furnished pellicles of gold of a deep brown color on their inner faces, and heavier than the gold originally employed in the gilding process. The pellicles not dissolved by the acid were therefore not pure gold.—They were proved by direct analysis to contain about three per cent. of copper or silver, according to which of these two substances the gilt article was formed.

M. Barral therefore considers it evident that when the amalgam of gold is applied to the surface of an article, a double amalgam of gold and copper or silver is formed. If the article be then submitted to heat, the mercury will be volatilized, and an alloy will be formed, thereby uniting the precious metal and the metal of which the article is formed. If the article gilt be then acted upon by nitric acid, the metal of which it is formed will be completely dissolved, and the acid will act upon the alloy, and carry off the copper or silver near the inner surface, where the gold is in small quantity. But, as the proportion of gold increases near the outer surface, it will preserve the other

metal from dissolution, as is well known to be the case with all alloys in which gold predominates.

It will therefore be understood, that the pellicles detached from articles gilt with mercury must be covered on their inner surface, after being acted on by the nitric acid, with a very thin layer of gold, which gives it a brown color; this will also explain the reason why nitric acid leaves the gold in an impure state after the destruction of the base metal of the articles.

When an article to be tested has been gilt by electro-chemical means, it will be found that the pellicle of gold covers the copper or silver, without amalgamating therewith; and therefore the nitric acid will not act upon the layer of gold.

The foregoing explanation proves the new methods of gilding to be less solid than the old ones; for it is evident that a layer merely laid on like a coat of paint, cannot adhere so tenaciously as when the metals are to a certain extent incorporated. Experience has proved, however, that the processes of electro-gilding and gilding by simple immersion possess certain advantages over the old methods. The pellicle obtained from the gilding by mercury, when held up to the light, presents an appearance of being perforated with numerous fine holes; this effect is produced by the passage of the mercury through the gilding when driven off by evaporation. Layers of gold deposited by a battery or by immersion are, however, perfect coatings; and, consequently, for domestic purposes—especially for vessels intended to come in contact with acids—copper articles, gilt by the mercury process, possess disadvantages which are obviated by the new processes.—*Comptes Rendus.* Lon. Jour. of Arts & Sci.

On the Steam Jet. By Mr. Faraday.

In Mr. Faraday's former discourse on Mr. Barry's method of warming and ventilating the new House of Lords, he mentioned that a part of the means employed for securing a current of air sufficiently abundant to insure the required object was the use of a jet of high-pressure steam in the ventilating shaft of that building. The present evening Mr. Faraday devoted to a consideration of the physical conditions of such a steam-jet, and to the relations of the vapor discharged from it to the surrounding air. More than forty years ago, Dr. Young (Nat. Phil., vol. ii., p. 534) had shown that, wherever any elastic fluid was forced from a jet with but small velocity, the steam proceeded for some inches without observable dilatation, and then diverged into a cone; but that when the pressure on this vapor was increased, the apex of the cone approached the orifice of the jet; but whatever might be the amount of this pressure, the form of the cone continued the same. Mr. Faraday proceeded to notice the lines of motion of the particles constituting this cone of vapor. The rings of smoke produced by the combustion of bubbles of phosphuretted hydrogen on the surface of water were exhibited. The revolution of each of these hollow rings on the axis of the cylinder which forms it was pointed out, as was

their gradual expansion when rising into the air: and it was shown that each of these enlarging rings might be viewed as a magnified element of the cone of steam issuing from the jet. In the same class of effects Mr. Faraday placed the rotating clouds of smoke which are seen issuing from the chimneys of steamboats, &c. The force with which the particles of the air surrounding the cone of steam produced by a powerful jet were drawn towards it, were shown by various striking experiments. Hollow balls of one and two inches diameter were seen drawn into the cone, and sustained floating in the line of its axis, even when, by an arrangement of the apparatus, this axis was brought 35° out of the perpendicular. An upright glass tube, eighteen inches long and one inch diameter, having one extremity plunged into water and the other end drawn into a capillary jet, was visibly exhausted of its contained air (the water being drawn up from the lower end of the tube) when the capillary jet was placed within the in-draught of air occasioned by the cone of steam. In closing this part of his subject, Mr. Faraday explained the use which had been made of a cylindrical, or conical, jacket, to include this steam-cone, and thus to increase the draught-power of the jet. In the arrangement adopted by Mr. Barry for ventilating the House of Lords, this jacket is the ventilating-shaft itself; so that there can be no room for the entrance of air to form a downward current in the shaft. This mode of moving air has been adopted in lead-works and other manufactories, for the purpose of washing and condensing the smoke where noxious fumes are generated in the processes. Noticing the coolness of the high-pressure steam, even near the orifice of the jet, as being due to the quantity of cold air rushing towards it and diminishing its temperature, Mr. Faraday connected with this and the other phenomena the experiment of M. Clement Désormes—who showed that when steam, under high-pressure, is allowed to escape from an orifice pierced in a plate, and a flat disc is brought close to this plate, the plate and disc are made to adhere together. In this case, the elastic force of the steam issuing from the jet, and which tends to separate the plate and disc, diminishes rapidly in its course from the centre to the edges of the disc; at the same time, the radial currents, by their in-draught, as before illustrated, bring the two plates together with a power which is so much greater than the former that the surfaces adhere. Mr. Faraday finished by noticing the danger of conical safety-valves in high-pressure boilers, when the lateral expansion of the conical surface is large in proportion to the sectional area of the steam passage.—*Proceed. Royal Inst.*

London Athenæum.

An account of the Iron Barque Josephine, of Liverpool. By Capt. Masters, *who commanded her in the voyages she has made.*

The subject of iron vessels is one of great importance, and the use of that material in naval architecture has been steadily progressing since it was introduced for sea-going vessels by Mr. Manby, in the

steamer named after him, in 1821, and which was the only vessel that ever conveyed a cargo direct between London and Paris, without transhipment. Sanguine hopes had been entertained of introducing iron for vessels of war; but it appears from the partial accounts that have been made public of the results of the experiments at Woolwich and elsewhere, that the effects of cannon-shot upon iron vessels are more destructive than upon timber. The paper read was a plain and somewhat dry specification of the construction of the vessel, which will, however, when printed *in extenso* in the minutes of proceedings, be extremely useful. The main dimensions of the barque *Josephine* are—Length, over all, 99 ft. 3 in.; extreme breadth, 24 ft. 6 in.; depth of hold, 9 ft. 9 in.; register tonnage, 168 tons; by old measurement, 221 tons. She was of a peculiar build, differing from almost any other merchant-ship, being intended for service in the Mexican trade, and calculated to cross the bar of Tampico, and other impediments. She was entirely of iron, even to the bulwarks; and as she lay low in the water, drawing 9 ft. aft, and 8 ft. 8 in. forward, her ports were hung on hinges forward, so that they should act as valves, and allow the water to escape from the deck, and yet shut of themselves when she heeled over deep on her side. Her general rate of sailing was from 11½ to 12 knots per hour; she was very buoyant and very dry, rising well to the sea. There was great capacity for stowing the cargo, owing to the absence of large projecting timbers. She was somewhat damp forward and aft, but was very dry in the main hold. There was not found to be any difference in the health of the crew from that of wooden vessels; she was a little cooler than other ships, owing to her being so deep in the water, and the thin material did not retain the heat like wood. Iron ships have generally been found to get very foul: the *Josephine* was, however, paid with various compositions as experiments. That which succeeded best was—1 barrel of varnish, 2¾ cwts. of best tallow, 40 lbs. black lead, 7 lbs. brimstone, and 70 lbs. arsenic. This being applied hot, the iron having been previously warmed and paid with boiled linseed oil, appeared to have prevented foulness, as after her voyages there was little weed or grass, and scarcely any barnacles; but very slight oxidation took place, and that only where the composition had been rubbed off. They were as much annoyed by rats as in a timber ship, nor could they be destroyed by any of the means adopted. The principal feature of the paper was that which treated of the local attraction of the compass, which can scarcely be given in an abridged form. It appeared that as long as the ship was on an even keel, and perfectly upright, the compass acted correctly, but in proportion to the listing over so was the derangement of the magnet, the local attraction being changed by the side frames and deck-beams falling into new positions. This caused great variation in the ship's course, and it led to conjecture whether this may not have been the cause of the loss of the *Great Britain*—as if her compasses were acted upon as much as those of the *Josephine*, a deviation of 6½ miles from her course might easily have occurred. Capt. Masters suggested the hanging the binnacles complete in gimbles like the compass, in order to their always remaining vertical, and also in ad-

justing the compasses, that they should be tried in every position, a table of variation being made out for every degree of listing over. The paper was illustrated by drawings of the vessel and of her rigging which possessed peculiarities, and also by several tables for the correction of the compasses.—*Proceed. Inst. Civ. Eng.* Min. Jour.

On the Law which Governs the Discharge of Elastic Fluids under Pressure, through short Tubes and Orifices. By W. Fronde, M. Inst. C. E.

The subject of the paper admitted of a much longer communication than could be read at one meeting, and the train of reasoning was such as could scarcely be perfectly entered into on merely hearing it read; nor is it possible, within our limits, to give a complete analysis of a paper, which, for accuracy of perception, closeness of reasoning, and terseness of diction, has rarely been equalled in any scientific society. A succinct review of it must suffice. The law proposed was a modification of that which has been usually assumed—viz: a simple application of that which holds good with respect to non-elastic fluids; this law is, generally, that the velocity of issue is directly as the square root of the pressure, and inversely as the square root of the density: but this law neglects wholly the reaction that must arise from the expansion necessarily taking place in the course of issue. The nature of the action was illustrated by the following example:—If a balance be supposed, with an equal weight in each scale, one of the weights being a spiral spring, like that of a spring balance compressed lengthwise with its axis vertical, and held in a state of compression by a cord. Now let the cord be suddenly reversed, so that the spring is enabled to extend itself vertically; the scale in which it stands will obviously be depressed, the spring reacting on it as it expands upwards, and continuing to press till wholly relaxed; or if the scale in which it stands were ascending by a preponderance given to the other scale, the rate of its ascent would be in the same way retarded. The amount of the retardation would depend on the strength and the weight of the spring, and on the length to which it would extend itself when released. Now in the discharge of an elastic fluid, there is an action strictly analogous, operating continuously, however, instead of *per saltum*, the strength and weight of the spring being represented by the elasticity and density of the fluid, and the length to which it would extend itself by the degree of expansion, in the course of issue. The reduction in quantity of discharge, due to the action, was to be measured by the velocity imparted by expansion, to each particle of the elastic fluid in course of issue, the velocity of each particle after expansion, would be its velocity before expansion, multiplied into the rate of expansion, and the primary force must be subdivided in generating each additional unit of velocity, so that the portion applicable to the generation of velocity before expansion, would be the whole force divided by the rate of expansion; thus, the velocity before expansion would be divided by the square root of that rate. For instance, an elastic fluid expanding four times in course of issue, would be discharged